Remedial Action Assessment Report
Getty Newark Terminal
86 Doremus Avenue
Newark, New Jersey 07105

Prepared for:

Texaco, Inc.
Environmental, Health and Safety
P.O. Box 509
Beacon, New York 12508

&

Getty Petroleum Marketing Inc.
86 Doremus Avenue
Newark, New Jersey 07105

Prepared by:

Quest Environmental & Engineering Services, Inc.
1741 Route 31
Clinton, New Jersey 08809

&

Tyree Environmental Technologies
1350 S. US Highway 130
Burlington, New Jersey 08016

May 12, 1998

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1.0 Introduction

This Remedial Action Assessment Report for the Getty Newark Terminal has been prepared by Quest Environmental & Engineering Services, Inc. and Tyree Environmental Technologies for joint review by Texaco, Inc. (Texaco) and Getty Petroleum Marketing Inc. (Getty). The objective of this assessment report is to provide Texaco and Getty with remedial alternatives and cost estimates for developing the most appropriate remedial action plan that will achieve the goal of closing this ISRA case. This assessment addresses remaining environmental areas of concern identified during previous remedial investigation/action and incorporates NJDEP requirements provided in previous written correspondence.

One concern in selecting appropriate remedial actions for this site is whether or not to involve institutional or engineering controls in the remediation plan. Institutional or engineering controls will impose restrictions to site use due to contamination remaining at a level above the NJDEP's applicable unrestricted use soil cleanup criteria. These controls are recorded in a Declaration of Environmental Restrictions (DER), which provides notice of the applicable restrictions. Involvement of institutional or engineering controls may impact the value of the property and also will affect the extent, type, and cost of remediation. Given this concern, remedial scenarios and cost estimates with and without the application of a DER are provided for comparison. In addition, applicable restrictions are discussed where appropriate.

Ten areas of concern currently are identified and require additional remedial investigation or remedial action. The AOCs are shown in Figure 1 and include:

East Yard

1. Loading Rack Area
2. Removed 1,000 Gallon No. 2 Fuel Oil UST
3. Pump and Bleeder Valves Area
4. Fuel Additive Tank Pump
5. Vapor Recovery Unit

West Yard

6. Removed 550 Gallon Waste Oil UST
7. 10,000 Gallon Aboveground Diesel Tank
8. Area A
9. Free Product Layer in Monitoring Well MW-18

Ground Water

10. Dissolved Ground Water Contamination

Remedial alternatives and cost estimates are provided for each AOC. The remedial costs are preliminary estimates based on assumed extent and types of contamination using existing information and based on a combination of average industry rates and Quest/Tyree rates for labor, equipment, and materials. Some AOCs will require additional remedial investigation to define the extent of contamination requiring cleanup. Therefore, costs for cleanup may vary extensively if the extent of cleanup is altered substantially based on the results of the additional investigation.

The soil cleanup criteria used for remedial action evaluation are the NJDEP Residential and Non-Residential Direct Contact Soil Cleanup Criteria last revised in July 1996. Impact to Ground Water Soil Cleanup Criteria are not considered to be applicable because these criteria regulate soil levels that are protective of ground water used as a source of drinking water, which includes Class IIA aquifers. Given that ground water in the vicinity of the site is not used as a source of drinking water and that the proximity of the Passaic River would prevent a potable use for ground water, Impact to Ground Water Soil Cleanup Criteria are deemed inappropriate for determining a need for a remedial action.

GETTY NEWARK TERMINAL

WEST YARD

EAST YARD

NEW JERSEY TURNPIKE

DOREMUS AVENUE

PASSAIC RIVER

MW-18 FREE PRODUCT LAYER

REMOVED 1000 GAL. NO.2 FUEL OIL UST

REMOVED 550 GAL. WASTE OIL UST

ABOVEGROUND 10,000 GAL. DIESEL TANK

LOADING RACK AREA

PUMP AND BLEEDER VALVES

VAPOR RECOVERY UNIT

FUEL ADDITIVE TANK PUMP

AREA A

MW-01 MW-02 MW-03 MW-04 MW-05 MW-06 MW-07 MW-08 MW-09 MW-10 MW-11 MW-12 MW-13 MW-14 MW-15 MW-16 MW-17 MW-18

TANK #10 54,000 BBL. UNLEADED REGULAR

TANK #11 54,000 BBL. UNLEADED REGULAR

TANK #8 21,000 BBL. NO. 2

TANK #9 54,000 BBL. PREMIUM

TANK #5 21,000 BBL. DIESEL

TANK #6 21,000 BBL. PREMIUM

TANK #7 21,000 BBL. UNLEADED REGULAR

TANK #1 5200 BBL. PREMIUM

TANK #2 5200 BBL. KEROSENE

TANK #4 5200 BBL. KEROSENE

TANK #3 5200 BBL. FUEL OIL

OFFICE

CONCRETE LOADING RACK

ROOF

LOCKER ROOM

DISPATCH OFFICE

GARAGE

LOADING DOCK

OIL / WATER SEPARATOR

MOORING PIER

MOORING PIER

AUTOMOTIVE REPAIR BLDG.

TRANSFORMER

TRANSFORMER HUT

METAL CONTROL BLDG.

DRUM STORAGE AREA

WAREHOUSE

FOAM BUILDING

STEEL PLATE

GRAVEL

EDGE OF PAVING

CONC. VAULT

CONC. SLAB & M.H.'S

CONC. FILLER PAD

CONC. SLAB

CONC. PUMP HOUSE

CONC. & STEEL PIPE RACK

6" CURBING

DIKE WALL

EDGE OF PAVEMENT

PARKING

TRUCK TRAFFIC

TRAFFIC

GATE

EDGE OF PAVEMENT

CONC. RISER

DIKE

GRAVEL

50 0 50 100

SCALE OF FEET

LEGEND:

PROPERTY LINE

MONITORING WELL

Quest Environmental & Engineering Services, Inc.
1741 ROUTE 31, CLINTON, NJ 08809
(908)730-7707

FIGURE 1
SITE MAP WITH AREAS OF CONCERN

CLIENT NO.	FILE NO.	CHK'D:	DRAWING NUMBER	REV. NO.
11001	–	ENG.	FAOC	
		APPVD.		

932960009

2.0 Loading Rack Area

Description of Area of Concern, Soil Contaminants and Extent

The area surrounding the Loading Rack is paved with asphalt, which is approximately 4 to 5 inches thick. Storm water drains and pipelines are located north, south and east of the Loading Rack. Approximately 2-3 feet of fill underlies the pavement and consists of gravel, crushed asphalt, and a mixture of sand and silt. Beneath the fill material, the natural soil consists of dark gray organic clay/silt and brown peat and sand. Ground water is shallow, occurring approximately 2-2.5 feet below ground surface.

Remedial investigation conducted between 1990 - 1995 has indicated soils impacted with Total Petroleum Hydrocarbons (TPHC), Benzene, Benzo(a)pyrene, and Total Lead at levels exceeding Residential (unrestricted use) and Non-Residential (restricted use) soil cleanup criteria (SCC). Of these constituents, TPHC and benzene are the primary contaminants of concern (COCs) and have impacted soil to a greater extent than the other contaminants.

Summary of Constituents Exceeding Soil Cleanup Criteria at the Loading Rack

Parameter	Conc. Range Exceeding SCC (mg/kg)	Residential SCC (mg/kg)	Non-Residential SCC (mg/kg)
Total Petroleum Hydrocarbons (TPHC)	11,000 – 74,000	10,000	10,000
PAHs			
Benzo(a)pyrene	0.76 – 3.1	0.66	0.66
VOCs			
Benzene	1.4 – 39	3	13
Ethylbenzene	200 (one sample)	1,000	1,000
Xylenes (total)	20 –210	410	1,000
Lead	6,430 (one sample)	400	1,000*

Notes:

(1) * indicates 1990 Cleanup Plan approval level for continued use as an Petroleum Terminal

(2) PAHs = Polyaromatic Hydrocarbons

(3) VOCs = Volatile Organic Compounds

Delineation of these COCs is nearly complete. Based on existing data, the estimated area

surrounding the Loading Rack where TPHC and Benzene exceed Non-Residential SCC is at least 14,000 ft^2 and is at least 17,000 ft^2 for the Residential SCC. Figure 2 illustrates these areas. Assuming an average depth to ground water of 2.5 feet, the volume of soil above the water table requiring remediation is at least 1,300 yds^3 for Non-Residential SCC and at least 1,600 yds^3 for the Residential SCC. These volumes include the thickness of the asphalt pavement. Soil beneath the Loading Rack is not included in this volume estimate. Investigation of this soil has not been required by the NJDEP because it is considered to be below the water table and is not accessible for sampling.

One concern for the estimated extent of benzene contamination is that it is based on a sampling and analysis method for volatile organic compounds (VOCs) that is no longer acceptable by the NJDEP. A new sampling and analytical method for VOCs known as the Methanol Preservation Method is now required. This method has been shown to yield consistently higher concentrations (by as much as an order of magnitude) than the previous method since it minimizes the loss of VOCs by volatilization and biodegradation from the time of sample collection to the time of laboratory analysis. If the NJDEP requires additional delineation or if post-remediation sampling in this area is warranted, then the extent of soil remediation due to benzene contamination will likely increase.

Free Product

During the June 1996 supplemental ground water investigation, a free phase product layer, product sheens, and elevated concentrations of dissolved BTEX, MTBE, and TBA were detected in well points installed adjacent to the Loading Rack. A free phase product layer was detected near the southeast corner of the Loading Rack. Elevated dissolved concentrations of BTEX (2 - 5 mg/L), MTBE (97 mg/L), and TBA (16 mg/L) were detected in a well point near the northeast corner of the Loading Rack. A product coating on the well point casing upon retrieval was also noted at this well point. These areas are likely acting as sources for a dissolved contaminant plume migrating toward the Passaic River. This is evident at downgradient well MW-14, which has shown an increasing trend in dissolved benzene concentration. Delineation of free product is required per the NJDEP Technical Requirements for Site Remediation (N.J.A.C. 7:26E:4.4(h)3i). The NJDEP has also required investigation of product sources and extent in previous correspondence. In addition, if Texaco/Getty decide to propose a no action or natural remediation plan for dissolved ground water contamination, the NJDEP will require that free and/or residual product be treated, removed, or contained as a condition of approval. Therefore, delineation and removal of the free product surrounding the Loading Rack is considered to be a required remedial action for this AOC.

Another objective for consideration is reducing the elevated dissolved BTEX, MTBE, and TBA concentrations adjacent to the Loading Rack, which currently represent a source area for the dissolved contaminant plume migrating toward the Passaic River. Reducing the elevated BTEX concentrations will diminish this source and could reduce the length of long term ground water monitoring of this area.

2.1 Remediation of Soil Without Restrictions (No DER)

Remediation to achieve unrestricted use without a DER requires cleanup of soils to the Residential (unrestricted use) SCC. Remedial alternatives considered for this area include soil vapor extraction, in-situ bioremediation, and excavation and off-site disposal. An evaluation of each alternative is provided below.

2.1.1 Soil Venting (Vapor Extraction)

In May 1990, a soil venting pilot test was conducted by IT Corporation. The results of this pilot test indicated that while air could be induced to flow through the subsurface soil, soil venting was not feasible because:

- the shallow water table is a limiting factor for efficient venting of the soils;
- soil venting is best suited for the removal of the volatile compounds (e.g. benzene) and would not be effective at removing the semi-volatile or non-volatile compounds or metals.

Therefore, soil venting alone would not be recommended.

2.1.2 In-Situ Bioremediation

Bioremediation is a proven and cost-effective technology for remediating petroleum hydrocarbons; however, it is not effective at degrading Lead and more recalcitrant hydrocarbons such as Benzo(a)pyrene. Application of bioremediation in the East Yard would be *in-situ* since this area will continue to operate as a loading area for tanker trucks and, therefore, will require minimal hindrance for loading operations over the long term. An in-situ system would require: (1) water or air as a carrier medium for oxygen and nutrient supplements that enhance bioremediation activity; and (2) an engineered delivery system for the oxygen/nutrient supplements. Ground water recovery would be required for a water carrier system to prevent undesired migration of contaminants beyond the area of concern. Therefore, an air carrier system or bioventing/air sparging system would be the preferred bioremediation system.

Given the above scenario, the following concerns for this alternative include:

- the effectiveness of the delivery system will be hindered by the shallow water table;
- the addition of nutrients to ground water will require a NJPDES Discharge to Ground Water Permit w/ quarterly monitoring events;
- a detailed engineering design would need to be developed;
- some hindrance to tanker truck loading activities will take place;
- treatment of soil to achieve cleanup criteria would likely take a year or longer, particularly where there are elevated concentrations (> 30,000 mg/kg) of petroleum hydrocarbons and elevated PAH concentrations. Therefore, excavation and removal of soils where elevated TPHC concentrations (> 30,000 mg/kg) exist is recommended.

Bioremediation System

An in-situ bioremediation system was evaluated in order to develop a comparative cost to the excavation and disposal alternative. The most effective in-situ bioremediation system would be comprised of a combination of two standard technologies, soil vapor extraction and air sparging. Air sparging systems are generally used to volatilize or "strip" volatile compounds from the saturated zone by introducing a compressed air stream several feet below the water table. However, when the compressed air stream is delivered at a slow flow rate, the primary advantage would be the addition of oxygen to enhance biological activity. At a low flow rate, some compounds will be volatilized and, therefore, must be captured by a soil vapor extraction system. Air sparging would be accomplished by installing several vertical wells at various locations around the site.

The soil vapor extraction system would induce a flow rate through the unsaturated zone, which would provide oxygen to the unsaturated zone. The soil vapor extraction system's induced flow rate would cause a subsurface vacuum gradient to be established and would capture volatilized compounds. Since there is only the concern of removing small amounts of volatiles from the subsurface, the flow rate of the system would be relatively low compared to a standard soil vapor extraction system. Since the ground water table is so shallow, horizontal extraction wells would be best suited for the site. The horizontal wells would be installed at various locations around the site. The vapors removed from the subsurface must be discharged in compliance with an Air

Discharge permit. The specifics of the air discharge permit may require the use of vapor treatment controls prior to discharging the vapor stream to the atmosphere.

The nutrients would be introduced to the subsurface via several injection points located at various points around the site. A Discharge to Ground Water permit is required to inject nutrients, or any solution, to ground water. The nutrients would be injected in batch cycles as defined by a detailed engineering plan.

A subsurface piping network would need to be installed to perform the bioremediation activities described above. The operation of the bioremediation system would not hinder trucking operations on a daily basis. However, the trucking operations would be hindered for a short term while the piping network was being installed. During trenching operations for the subsurface piping installation, if impacted soil is encountered, it should be disposed of, as well as areas of elevated TPHC concentrations. By removing as much of the most heavily impacted soil as possible, the amount of soil to be treated *in-situ* is reduced, thereby, reducing the time needed by the active treatment system to achieve clean-up goals.

The difference between the bioremediation approach as compared to the standard soil vapor extraction/air sparging approach, would be that of cost. Since the air sparge delivery system and the soil vapor extraction system would both be operated at low flow rates, the cost for equipment size and utilities would be greatly reduced. The primary purpose of this remedial strategy is to induce the indigenous biological organisms to digest the petroleum hydrocarbons at a faster rate then they normally would by providing oxygen and nutrients to the subsurface.

Cost

Estimated costs for construction for this in-situ bioremediation system are provided in Table 2-1. The estimated costs include a three-year operation and maintenance period.

A. Construction / Engineering Costs	=	$ 409,000
B. 3-yr Operation & Maintenance Cost	=	$ 301,000
Total Cost	=	$ 710,000

Costs for excavation and disposal of elevated TPHC, PAH, or Lead areas are not included in this cost.

2.1.3 Excavation and Off-Site Disposal

Excavation would be effective at removing all constituents from the Loading Rack Area. It does not require an engineering design, is comparatively easily to implement, and can achieve remedial objectives over a short time period (1-2 months). Excavated materials could be disposed of in an appropriate landfill or recycled into asphalt. Concerns for excavation and off-site disposal/recycling include:

- requires a Soil Erosion and Sediment Control Plan;
- causes some hindrance to tanker truck loading operations;
- is generally a more costly alternative.

Design

The following activities are assumed for this alternative:

- Additional soil sampling to delineate remaining few areas to Residential SCC;
- Installation of soil erosion and sediment controls and storm water provisions;
- Removal of asphalt pavement and excavation of soil/fill (assume an increase to 2,000 cubic yds with Methanol Preservation Method);
- Transportation and disposal of 3,000 tons of waste;
- Post-excavation sampling (sidewall only) to meet Technical Requirements to document clean zones;
- Further excavation based on the results of post-excavation sampling, if needed.
- Backfilling, grading, and paving excavated areas.

Soil will be excavated to the water table and placed directly into trucks for subsequent transport to an off-site regulated landfill. After excavating, post-excavation sidewall samples will be collected at locations where remedial investigation samples were not previously collected to document clean zones. After post-excavation sidewall sample results indicate that all contaminated material has been removed, the excavation will be backfilled with certified clean fill and sub-base and paved with asphalt.

Excavated materials will be transported in dump trailers. Approved landfills or recycling facilities are available within acceptable distance for transport. Since the required materials,

equipment and labor are readily available, this remedial alternative can be implemented but with minor operational difficulties. Excavation can be achieved within 1-2 months, depending on the accessibility of areas surrounding the Loading Rack during truck loading operations.

Dust control measures may be required. A construction staging and management area will be also required which will include a decontamination area for excavation equipment and trucks, a support zone and an exclusion zone.

Limiting Factors

The excavation of the fill may present minor technical difficulties due to the location of the water table, which is approximately 2.5 ft below ground surface. Stabilization of some fill materials may be required during excavation due to saturated conditions. Of greater concern is the possibility of damaging underground utilities (i.e. storm water drains, sanitary sewer lines, and potable water lines), particularly since the locations of underground utility pipelines are not well known.

Cost

The estimated costs for this alternative are shown in detail in Table 2-2. Excavated material is assumed to be non-hazardous for disposal or recycling at an approved facility. A representative cost for transportation and disposal is used in the estimate. Estimated costs are:

A. Soil Delineation	=	$ 22,000
B. Excavation/T & D/Engineering Costs	=	$ 411,000
C. Total Cost (Non-Hazardous Waste)	=	$ 433,000

It is possible that a portion of the excavated soil may be classified as a characteristic hazardous waste due to elevated concentrations of benzene and total Lead in some areas that would result in TCLP concentrations exceeding regulatory limits. These soils should be segregated from the other soils and disposed of a hazardous waste. The cost of hazardous waste material is typically 3 - 5 times higher than non-hazardous waste disposal. At this time, it is difficult to predict the percentage of soil that may be classified as hazardous, particularly since TCLP analysis has not been performed on Loading Rack soils. For purposes of comparing costs, we can assume that up to 50% of the total volume (1,000 cy or 1,500 tons) excavated will be classified as hazardous. Assuming an average transportation and disposal cost of $160/ton hazardous T & D (versus $55/ton for non-hazardous), the cost of this alternative would increase by at least $ 160,000, pushing the total cost above $ 550,000.

2.2 Remediation of Soil With Institutional Controls (DER)

Remediation to achieve Non-Residential (restricted use) SCC would require the application of institutional controls recorded in a DER that would restrict the area to non-residential uses. The volume of soil assumed for cleanup under this scenario is 1,500 cubic yards. Costs are estimated using excavation and off-site disposal to predict the cost difference between achieving restricted versus unrestricted use objectives.

Institutional Controls

A Declaration of Environmental Restriction (DER) will be applied to the East Yard for restricting use to Non-Residential purposes. The DER will specify the affected area, the contaminant levels remaining in the area above the Residential SCC, and restrictions to future site use.

Cost

The cost estimate for this alternative is shown in Table 2-3.

A. Soil Delineation	=	$ 16,000
B. Excavation/T & D/Engineering Costs	=	$ 325,000
C. Total Cost (Non-Hazardous Waste)	=	$ 341,000

If a third of the excavated soil is classified as a characteristic hazardous waste, the total cost would likely exceed $ 400,000.

2.3 Remedial Action with Engineering and Institutional Controls (DER)

A remedial action using an engineering control to prevent exposure to soil contaminants was also considered as a viable alternative. An engineering control is a physical mechanism to contain or stabilize contaminants and can include covers, caps, signs, fences, and access controls. A DER will also be required to record the location of the engineering control, the extent of contamination, and site use restrictions. A cap is considered as the best engineering control for this area. A single barrier cap is the most suitable given that this area will remain as an active loading area. Because asphalt pavement exists in the Loading Rack Area, it is only natural to select asphalt as the cap material. Other types of caps such as a synthetic liner and clay soil layer obviously would not be appropriate for this area.

The main functions of the single barrier asphalt cap would be to reduce surface infiltration, prevent direct contact, limit gas emissions, and control erosion. The cap does not reduce the toxicity or volume of the contaminants, but it does address contaminant exposure and mobility. The cap eliminates most risk pathways associated with the soil and is protective of human health and partially protective of the environment since it does not allow for storm water infiltration and leaching to ground water.

Design

The paved area surrounding the Loading Rack would be upgraded to provide a more impermeable surface and greater structural integrity to accommodate truck traffic. A total area of 55,000 ft^2 is assumed for capping. Specific remedial actions assumed for this alternative include:

- filling/sealing large cracks, pot holes, subsided areas, and other structural impairments;
- upgrade storm water/oil collection system to accommodate additional pavement thickness;
- application of a tack coat and impregnated geotextile to existing pavement;
- construction of a 2-inch wearing course of asphalt.

An impregnated geotextile is recommended because it will retard reflective cracking, increase the pavement life, and reduce long term maintenance costs.

Maintenance

Routine inspection and maintenance of the asphalt will be required to ensure that the cap maintains its integrity. Pursuant to N.J.A.C 7:26E-6.1 (Technical Requirements), the cap is required to be re-evaluated by the property owner at a frequency determined by the NJDEP, typically every 5 years. The re-evaluation will at a minimum include a physical inspection of the cap and a review of the continued adequacy of all institutional controls.

Institutional Controls

A Declaration of Environmental Restriction (DER) will be applied to the East Yard restricting the use to Non-Residential. The DER will specify the affected area, the contaminant levels remaining in the area above the Residential and Non-Residential criteria, restrictions of future site use, and provisions on alterations, improvements and disturbances. Construction on the cap

would be allowable, but would require at a minimum notification to the NJDEP and repair of any cap disturbance to maintain integrity.

Ground Water

Because soil constituents will remain, the soil will act as a potential source to ground water during seasonal water level variations, and consequently, as a potential source to surface water via migration. Long term monitoring will likely be required to document that levels in downgradient well MW-16 will not exceed Surface Water Quality. For purposes of evaluating costs for this alternative, it is assumed six (6) years of semi-annual monitoring will occur. Assumed monitor wells include one upgradient well (to be installed) and one downgradient well (MW-16). Assumed monitoring parameters include Volatile Organic Compounds, Base Neutral Compounds, and Total Lead. Barring any additional sources, natural degradation of petroleum hydrocarbons in soil and the ground water plume will likely result in decreasing ground water concentrations during the monitoring period. The NJDEP may also establish a Classification Exception Area (CEA) for this area. A CEA is an area of the aquifer that currently and is anticipated to be impacted above applicable Ground Water Quality Standards pursuant to N.J.A.C. 7:9-6.

Cost

The estimated costs for this alternative are shown in detail in Table 2-4. Costs are separated into Construction/Engineering Costs, Maintenance Costs, and Ground Water Monitoring. Long term maintenance and ground water monitoring costs are estimated using a present worth analysis. Estimated costs for this alternative are:

A. Construction / Engineering Costs	=	$ 108,000
B. Maintenance Costs (30-yr Present Worth)	=	$ 17,000
C. Ground Water Monitoring (6-yr Present Worth)	=	$ 33,000
Total Present Worth	=	$ 158,000

2.4 Loading Rack Soil Remedial Alternative Summary

The remedial alternatives evaluated for the Loading Rack Area are considered to be protective of human health. Although each alternative offers some degree of protection of ground water and

surface water (Passaic River), the cap alternative would be the least protective and would likely require a longer period of ground water monitoring than the removal alternatives.

Given that costs for excavation and off-site disposal/recycling would likely be less than bioremediation and that excavation can achieve the remedial objective in a comparatively short time period, excavation is recommended as a treatment/removal remedy, if selected. However, estimated costs for the excavation and disposal alternatives are at least 3 times greater than the cap alternative for unrestricted use and twice as much as a cap with restrictions.

In terms of execution, the capping alternative will be easier to implement. It is estimated that upgrading the existing asphalt could be accomplished within two weeks assuming no operational impediments. The logistics for excavating are more involved, and completing excavation, backfill and paving will take longer, perhaps up to six to eight weeks assuming no operation impediments. Consequently, a greater disruption to the loading activities may be expected if the excavation alternative is selected.

2.5 Free Product Delineation and Remediation

Free Product Delineation

Delineation of free product surrounding the Loading Rack can be accomplished using temporary well points. Twelve temporary well points are proposed for delineation of free product. Figure 3 illustrates the proposed locations. Well points will be installed within 20-35 foot intervals surrounding former points EY-2 and EY-8. The temporary well points will be installed to a depth of approximately 4 feet below ground surface using a Geoprobe to minimize the amount of soil cuttings generated. A Macro-Core Soil Sampler (2-inch diameter - 4 foot length) will be used to provide the borehole. The collected soil core will be inspected for the presence of free phase product, particularly within the capillary fringe interval. A 1-inch PVC well screen with riser casing will be placed in the borehole. The riser casing will stickup only ~1" and maybe be surrounded with a temporary asphalt patch mound, if necessary, to allow vehicular traffic to pass. The wells points will be checked for the presence of free product using a clear bailer or electronic gauging tape immediately after installation and checked again after allowing to stand for 24 to 48 hours. The well points will be removed and the resulting boreholes grouted. Samples for dissolved BTEX, MTBE, and TBA can also be collected from 2 to 4 of the outer well points to investigate whether elevated concentrations exist further out from the Loading Rack.

Free Product Remediation

The extent of free product in this area has not yet been delineated, therefore it is difficult to provide an actual scope of work and costs to remediate this area. It is suspected that the extent of free product is limited to the area immediately surrounding the Loading Rack. Therefore, a remedial approach and cost estimate are provided assuming a limited extent of free product in which a product layer occurs in a 10 foot by 40 foot area on each side of the Loading Rack. The free product is assumed to be restricted to the fill layer, which is more permeable than the underlying natural soils. The objectives for the remediation are:

1. To remove both mobile and residual free product from the water table and smear zone (capillary fringe).

2. To minimize the generation and subsequent treatment or disposal of groundwater and soil.

3. To accomplish the remediation within a relatively short time frame (~3-6 months).

Conventional mobile product recovery systems whereby ground water and free product are recovered via wells or trenches was considered. However, these systems typically remove less than 50% of the total product volume and allow residual product to remain and act as a continual source of dissolved hydrocarbon contamination. Therefore, an alternate approach was considered. The approach recommended is surfactant enhanced product recovery and passive bioremediation treatment of residual hydrocarbons. Surfactants can increase the solubility of LNAPL constituents by forming micelles and microemulsions or can mobilize residual hydrocarbons by reducing interfacial tensions. These processes will change the hydrocarbons to a more mobile and recoverable phase and allow more efficient microbial degradation of residual hydrocarbons in the smear zone.

The scope of this remedial alternative involves surfactant injection using a combination of shallow (5 feet) 4-inch monitoring wells and small diameter (1-inch), shallow (2-3 feet) injection points. Emulsified and desorbed product and impacted ground water will be recovered and disposed of off-site. To minimize the migration of dissolved contaminants desorbed from soils in this area, it is recommended that nutrients and an oxygen-enhancing material such as Oxygen Release Compound® (ORC) be injected into the well points to enhance biodegradation of the remaining hydrocarbons. The ORC injection will enhance oxygen concentrations to facilitate the aerobic biodegradation of hydrocarbons. The nutrient injection will provide nitrogen and phosphorus necessary for microbial cell growth. The following details the remediation steps.

1. Discharge Permit

NJDEP regulations require Department issuance of a permit-by-rule authorization for the short-term discharge of surfactant and nutrients. An application for this authorization shall be submitted to the NJDEP.

2. Well Installation

Depending on the distribution of the free product layer, wells/injection points will be installed in order to ensure full coverage of the product layer with the surfactant. For purposes of this remedial scenario, four wells and sixteen temporary injection points are assumed for injection/recovery, two wells and eight injection points on each side of the Loading Rack. The wells will be spaced approximately 20 feet apart and will be used for injection, recovery, and monitoring. The injection points will be located at points surrounding the wells to ensure complete coverage of the product layer. Wells will be completed with flush-mounted casings. The temporary injection points will be removed following oil recovery.

3. Surfactant Injection

A dilute solution of surfactant (such as 2-3% BioSolve®) will be injected into the wells/injection points using a pump in an attempt to saturate the free product layer with the surfactant. The injection wells will be surge blocked to ensure adequate distribution of the surfactant solution.

4. Recovery

After approximately 24 to 48 hours, recovery of product and impacted ground water will be conducted employing a vacuum truck. The wells will act as the primary recovery points, while the injection points will act as secondary extraction points. The duration of recovery will be approximately 8 hours. An SVE Pilot Test application and fee are required to use a vacuum truck for extraction. The injection point boreholes will be sealed following recovery.

5. Additional Injection/Recovery Event

A second injection and recovery event will be conducted to ensure complete recovery of the product layer. Small diameter injection points will be installed at different locations than the first injection event to provide better coverage of the product layer.

6. ORC and Fertilizer Addition.

After the second injection/recovery event, a dilute slurry of ORC and a solution of 5:1 fertilizer will be added to stimulate the natural bacteria to biodegrade the dissolved contaminants. The

ORC and fertilizer will be added to two of the existing wells (one on each side of the Loading Rack). The other two wells will be used for ground water sampling. It is also recommended that ORC and fertilizer be added to six additional boreholes (three on each side of the Loading Rack) in areas outside of the product area to address dissolved contamination in these areas. The ORC and fertilizer will be injected using a Geoprobe ORC Injection System that is capable of dispersing the slurry from the wells/boreholes into the surrounding soils.

7. Monitoring

Ground water will be monitored for dissolved contaminants and the injection constituents. Prior to the ORC and fertilizer addition, the two monitoring wells not injected with fertilizer and ORC will be sampled for BTEX, surfactant agents (methylene blue active substances), dissolved oxygen, ammonium, nitrate, and orthophosphate. The wells will be sampled one month and three months after the ORC and fertilizer addition.

8. Abandonment

Following successful cleanup of the area, the monitoring wells will be proposed for abandonment.

Cost

Table 2-5 provides a cost estimate for delineation and remediation including labor, equipment, materials, for installation, borehole grouting, supervision, sampling, data evaluation/reporting, and project management. The costs are summarized below:

A. Delineation	$ 4,800
B. Remediation/Monitoring	$ 24,500
C. Project Management/Report	$ 4,500
Total Cost	$ 33,800

The scope of work and cost will change if the actual product layer distribution decreases or increases based on the results of the delineation.

Table 2-1 **Preliminary Estimate of Costs For Installation & O&M of Biosparge/Biovent Remediation System Loading Rack Area - East Yard - Getty Newark Terminal**

A. Construction/Engineering

ITEM	Description	Quantity	Unit Cost	Total
1	Mobilization/Demobilization			
	+General Mobilization	LS	$1,500	$1,500
	+Decontamination Station	LS	$2,000	$2,000
2	Site Preparation			
	+Erosion Control Measures	1000 L.Ft	$6.00 / LFt.	$6,000
	+Storm Water Control Measures	LS	$400	$400
3	System Design			
	+Design	LS	$3,370	$3,370
	+Air Permit Preparation & Fees	LS	$5,875	$5,875
	+Equipment Procurement	LS	$150,000	$150,000
	+Local Permitting	LS	$2,500	$2,500
4	Subgrade Piping Installation			
	+Crew Chief	200 hrs	$67 / hr	$13,400
	+Second Man	200 hrs	$46 / hr	$9,200
	+Field Laborer	200 hrs	$37 / hr	$7,400
	+Equipment (Excavator, Roller, Tamper, Etc.)	LS	$7,500	$7,500
	+Backfill	690 tons	$13 / ton	$8,970
	+Asphalt	LS	$27,125	$27,125
	+Concrete	18 cu. yd	$94 / cu yd	$1,692
	+Bollards, rebar, wire, etc.	LS	$1,300	$1,300
	+PVC Pipe, fittings	LS	$23,837	$23,837
5	Equipment Installation			
	+Crew Chief	100	$67 / hr	$6,700
	+Second Man	100	$46 / hr	$4,600
	+Electrician & Service Drop	LS	$21,250	$21,250
	+System Enclosure Installations	LS	$26,500	$26,500
	+Heater, Lights, Misc. Materials	LS	$10,000	$10,000
6	DIRECT COST SUBTOTAL			$341,000
7	Construction Oversight		10%	$34,100
8	Contigency for Additional Legs of System		10%	$34,100
9	INDIRECT COST SUBTOTAL			$68,200
10	TOTAL CAPITAL COST			$409,000

B. Operation and Maintenance

ITEM	Description	Quantity	Unit Cost	Total
1	Operation and Maintenance			
	+System Startup	LS	$6,500	$6,500
	+O&M (3 years)	3 yrs	$18,000 / yr	$54,000
	+Vapor Phase Carbon Changeouts & Disposal	3 yrs	$19,500 / yr	$58,500
	+Utility Bills	36 months	$4,000 / month	$144,000
	+ Soil Monitoring / Post-Remediaton Sampling	LS	$25,000	$25,000
	+Air Sample Analysis	15 smp	$200 / smp	$3,000
	+Reporting	LS	$10,000	$10,000
2	TOTAL 3-YR O & M COST			$301,000

Summary

A. Construction/Engineering Cost =	$409,000
B. 3-Yr Operation and Maintenance Cost =	$301,000
C. Total Cost =	$710,000

LS = Lump Sum, L. Ft = Linear Feet, hrs = hours, sq yd = square yd

Notes:

(1) Total costs are rounded to the nearest $1,000.

Table 2-2 Preliminary Cost Estimate For Excavation and Off-Site Disposal For UnRestricted Use Loading Rack Area - East Yard - Getty Newark Terminal

A. Delineation

ITEM	Description	Quantity		Unit Cost		Total
1	Geoprobe Soil Sampling					
	+Geoprobe/Operator	3	days	$1,200	/ day	$3,600
	+General Mobilization	LS		$300		$300
	+Materials	LS		$300		$300
2	Oversight and Sampling	LS		$2,350		$2,350
3	Laboratory Analysis					
	+TPHC	30	smp	$45	/ smp	$1,350
	+Benzene, Total Xylenes	30	smp	$160	/ smp	$4,800
	+Lead	15	smp	$20	/ smp	$300
	+BNs	30	smp	$210	/ smp	$6,300
4	Oversight	LS		$1,500		$1,500
5	Project Coordination/Management/Data Evaluation/Report	LS		$1,000		$1,000
6	TOTAL COST					$21,800

B. Excavation / T & D / Area Restoration

ITEM	Description	Quantity		Unit Cost		Total
1	Mobilization/Demobilization					$7,000
	+ General Mobilization	LS		$5,000		
	+ Decontamination Station	LS		$2,000		
2	Site Preparation					
	+ Erosion Control Measures	600	L. Ft	$6.00	/L.Ft	$3,600
	+ Storm Water Control Measures	LS		$400		$400
3	Soil Excavation					
	+ Excavation	2000	cy	$6.00	/ cy	$12,000
	+ Sample Analysis (Postex. and TCLP)	LS		$22,000		$22,000
	+ Backfill, Grading and Paving	2400	sy	$40	/ sy	$96,000
	+ Non-hazardous disposal	3000	Tons	$55	/ Ton	$165,000
	+ Storm Water Management System Construction	LS		$20,000		$20,000
4	DIRECT COST SUBTOTAL					$326,000
5	Remedial Action Plan / Closure Report / Management	LS		$20,000		$20,000
6	Coordination, Excavation Layout, Engineering			3%		$9,780
7	Excavation Oversight and Post-Ex Sampling			7%		$22,820
8	Contingency (for additional excavation)			10%		$32,600
9	INDIRECT COST SUBTOTAL					$85,200
10	TOTAL CAPITAL COST					$411,000

Summary

A. Additional Soil Delineation =	$22,000
B. Excavation/T&D/Area Restoration =	$411,000
TOTAL COST =	$433,000

LS = Lump Sum
L. Ft = Linear Feet
CY = Cubic Yard
SY = Square Yard
Notes:
(1) Total costs are rounded to the nearest $1,000.

Table 2-3 Preliminary Cost Estimate For Excavation and Off-Site Disposal For Restricted Use Loading Rack Area - East Yard - Getty Newark Terminal

A. Delineation

ITEM	Description	Quantity		Unit Cost		Total
1	Geoprobe Soil Sampling					
	+Geoprobe/Operator	2	days	$1,200	/ day	$2,400
	+General Mobilization	LS		$300		$300
	+Materials	LS		$300		$300
2	Oversight and Sampling	LS		$2,350		$2,350
3	Laboratory Analysis					
	+TPHC	20	smp	$45	/ smp	$900
	+Benzene, Total Xylenes	20	smp	$160	/ smp	$3,200
	+Lead	10	smp	$20	/ smp	$200
	+BNs	20	smp	$210	/ smp	$4,200
4	Oversight	LS		$1,050		$1,050
5	*Project Coordination/Management/Data Evaluation/Report*	LS		$1,000		$1,000
6	TOTAL COST					$15,900

Excavation / T & D / Area Restoration

ITEM	Description	Quantity		Unit Cost		Total
1	Mobilization/Demobilization					$7,000
	+ General Mobilization	LS		$5,000		
	+ Decontamination Station	LS		$2,000		
2	Site Preparation					
	+ Erosion Control Measures	600	L. Ft	$6.00	/L.Ft	$3,600
	+ Storm Water Control Measures	LS		$400		$400
3	Soil Excavation					
	+ Excavation	1500	cy	$6.00	/ cy	$9,000
	+ Sample Analysis (Postex. and TCLP)	LS		$18,000		$18,000
	+ Backfill, Grading and Paving	1800	sy	$40	/ sy	$72,000
	+ Non-hazardous disposal	2200	Tons	$55	/ Ton	$121,000
	+ Storm Water Management System Construction	LS		$20,000		$20,000
4	DIRECT COST SUBTOTAL					$251,000
5	Preparation of Remedial Action Plan / Closure Report / DER	LS		$24,000		$24,000
6	Coordination, Excavation Layout, Engineering			3%		$7,530
7	Excavation Oversight and Post-Ex Sampling			7%		$17,570
8	Contingency (for additional excavation)			10%		$25,100
9	INDIRECT COST SUBTOTAL					$74,200
10	TOTAL CAPITAL COST					$325,000

Summary

A. Additional Soil Delineation	$16,000
B. Excavation/T&D/Area Restoration =	$325,000
TOTAL COST =	$341,000

LS = Lump Sum
L. Ft = Linear Feet
CY = Cubic Yard
SY = Square Yard
Notes:
(1) Total costs are rounded to the nearest $1,000.

Table 2-4 Preliminary Cost Estimate For Asphalt Cap and Restricted Use Loading Rack - East Yard - Getty Newark Terminal

A. Construction/Engineering Costs

ITEM	Description	Quantity	Unit Cost	Total
1	Mobilization/Demobilization			$2,000
	+ General Mobilization	LS	$2,000	
2	Site Preparation			
	+ Surface Preparation (Fill-in holes)	LS	$2,000	$2,000
	+ Interior Fence Removal	LS	$850	$850
3	Construction			
	+ Asphalt Cap Construction	55000 Sq Ft	$1.25 /Sq Ft	$68,750
	+ Raise Storm Water/Oil Collection System	LS	$4,000	$4,000
	+ Interior Fence Replacement	LS	$1,100	$1,100
4	DIRECT COST SUBTOTAL			$78,700
5	Remedial Plan / Closure Report/ Management/ DER	LS	$15,000	$15,000
6	Pre-Design Investigation, Engineering, Design		6%	$4,722
7	Construction Oversight		3%	$2,361
8	Contingency		10%	$7,870
9	INDIRECT COST SUBTOTAL			$29,953
10	TOTAL CAPITAL COST			$108,000

B. Maintenance Costs

ITEM	Description	Quantity	Unit Cost	Total
1	Pavement Maintenance (30 year period)	LS	$1,000	$1,000
2	0 - 30 Year Present Worth Maintenance Cost			$17,000

C. Ground Water Monitoring

ITEM	Description	Quantity	Unit Cost	Total
1	Well installation	1	$2,000	$2,000
2	Ground Water Monitoring - 6 years	2 evt/yr	$3,000 / evt	$6,000
3	0 - 6 Year Present Worth GW Monitoring Cost			$31,000
4	Total Cost (Well Installation (1) and 0-6 yr Present Worth (3)			$33,000

Summary

A. Asphalt Cap Design/Construction/Oversight/Closure Plan	$108,000
B. 0 - 30 Year Present Worth Maintenance Cost = (Yearly O & M Cost, 0 - 30 Yrs)x(P/A, 4%, 0 - 30 Yrs)	$17,000
C. 0 - 6 Year Present Worth Ground Water Monitoring Cost = (Yearly, 0 - 6 Yrs)x(P/A, 4%, 0 - 6 Yrs)+Well Installation	$33,000
TOTAL PRESENT WORTH	$158,000

LS = Lump Sum
Sq Ft = Square Feet
Evt. = Event

Notes:
(1) Total costs are rounded to the nearest $1,000.
(2) Interest rate set at 7%, Inflation rate set at 3%, Net P/A set at 4%.
(3) Asphalt Cap includes tack coat, Petro Geotextile Layer, and 2" FAC layer.

Table 2-5 **Preliminary Estimate of Costs For Loading Rack Free Product Delineation and Remediation East Yard - Getty Newark Terminal**

A. Delineation

ITEM	Description	Quantity		Unit Cost	Total
1	Geoprobe Well Point Installation and Borehole Grouting				$2,200
	+ General Mobilization	LS		$100	
	+ Geoprobe/Operator	1	day	$1,200 / day	
	+ Materials and Grouting	LS		$900	
2	Oversight and Sampling	LS		$1,000	$1,000
3	Laboratory Analysis				
	+ BTEX, MTBE, TBA	4	sample	$85.00 / smp	$340
4	Project Coordination/Management/Data Evaluation/Report	LS		$1,260	$1,260
5	TOTAL COST				$4,800

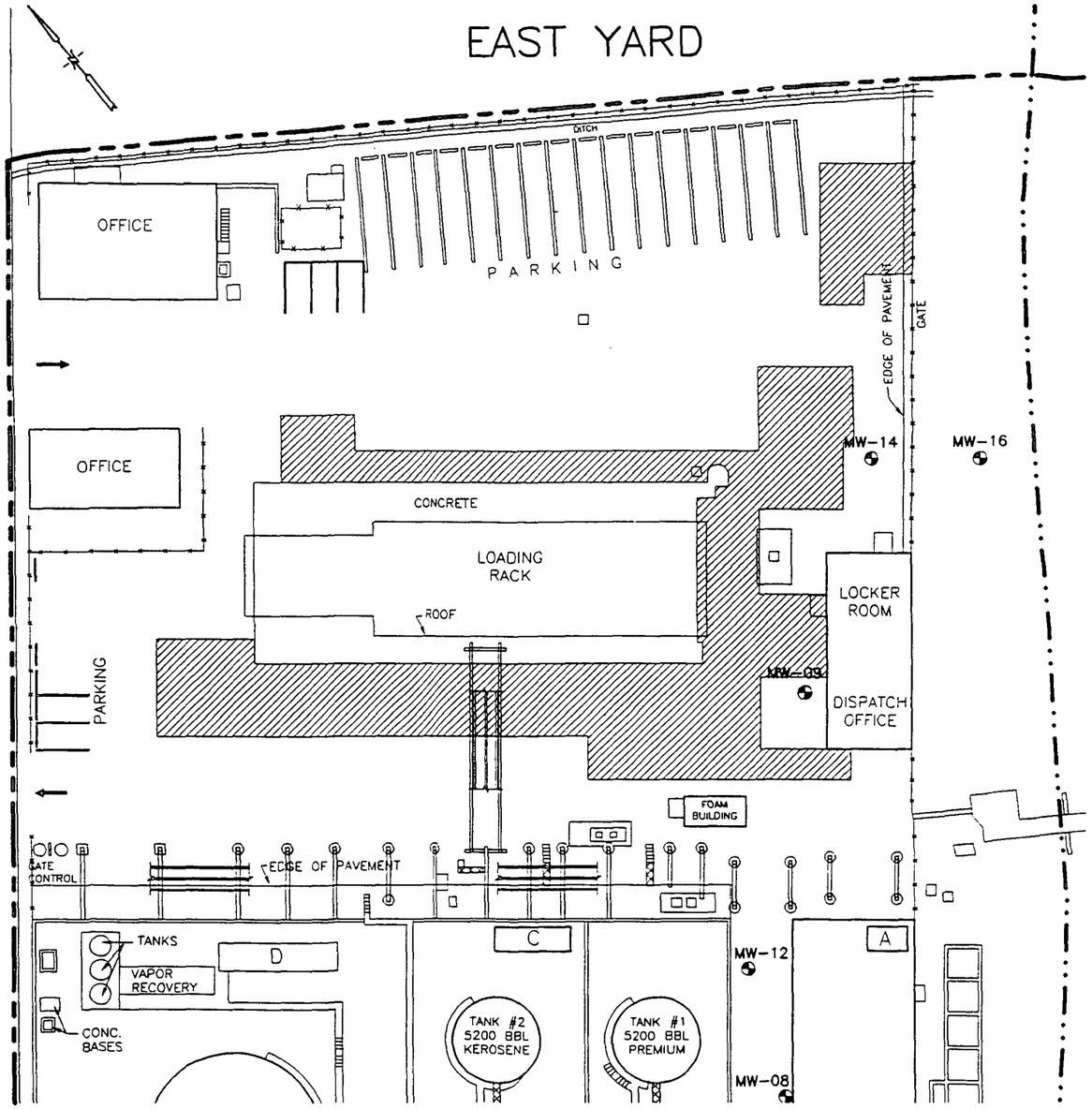
B. Remediation / Monitoring

ITEM	Description	Quantity		Unit Cost	Total
1	Well Installation				$4,350
	+ General Mobilization	LS		$100	
	+ Geoprobe/Operator	1	day	$1,950 / day	
	+ Permits and Well Materials	LS		$1,400	
	+ Geologist Oversight ($55/hr)+field vehicle, coordination	LS		$900	
2	Surfactant Injection (2 events)				
	+ Geoprobe Injection Point Installation	2	events	$1,800 / event	$3,600
	+ Geologist ($55/hr) & Field Tech. $ (40/hr)	2	events	$1,190 / event	$2,380
	+ Field Vehicle and Equipment	2	events	$260 / event	$520
	+ Materials (Biosolve, drum, tubing, grout, etc)	2	events	$1,200 /event	$2,400
			Subtotal		$5,300
3	Product Recovery (2 events), Disposal, Baseline Sampling				
	+ Geologist ($55/hr)	2	events	$690 /event	$1,380
	+ Vac Truck and Operator	2	events	$1,180 /event	$2,360
	+ Recovered Oil/ Water Disposal	2000	gals	$1.05 / gal	$2,100
	+ Equipment and Materials (Field Vehicle, Fittings, tubing)	2	events	$650 /event	$1,300
	+ Analytical (VO+10=$195, MBAS=$40, N=$55, P=$20	2	samples	$310 / samp	$620
			Subtotal		$7,760
4	ORC/Fertilizer Addition				
	+ Geologist ($55/hr)	1	day	$500 / day	$500
	+ Geoprobe ORC Injection System	1	day	$1,400 / day	$1,400
	+ Field Vehicle and Materials (80 lb ORC, Fertilizer, etc)	1	LS	$1,100	$1,100
			Subtotal		$3,000
5	Monitoring (2 events)	2	event	$1,350 / evt	$2,700
6	Well Abandonment	1	LS	$750	$750
7	Permit-By-Rule and SVE Pilot Test Application and Fee	1	LS	$700	$700
8	Closure Report	1	LS	$2,300	$2,300
9	Project Coordination, Management	1	LS	$2,180	$2,180
10	TOTAL COST				$29,040

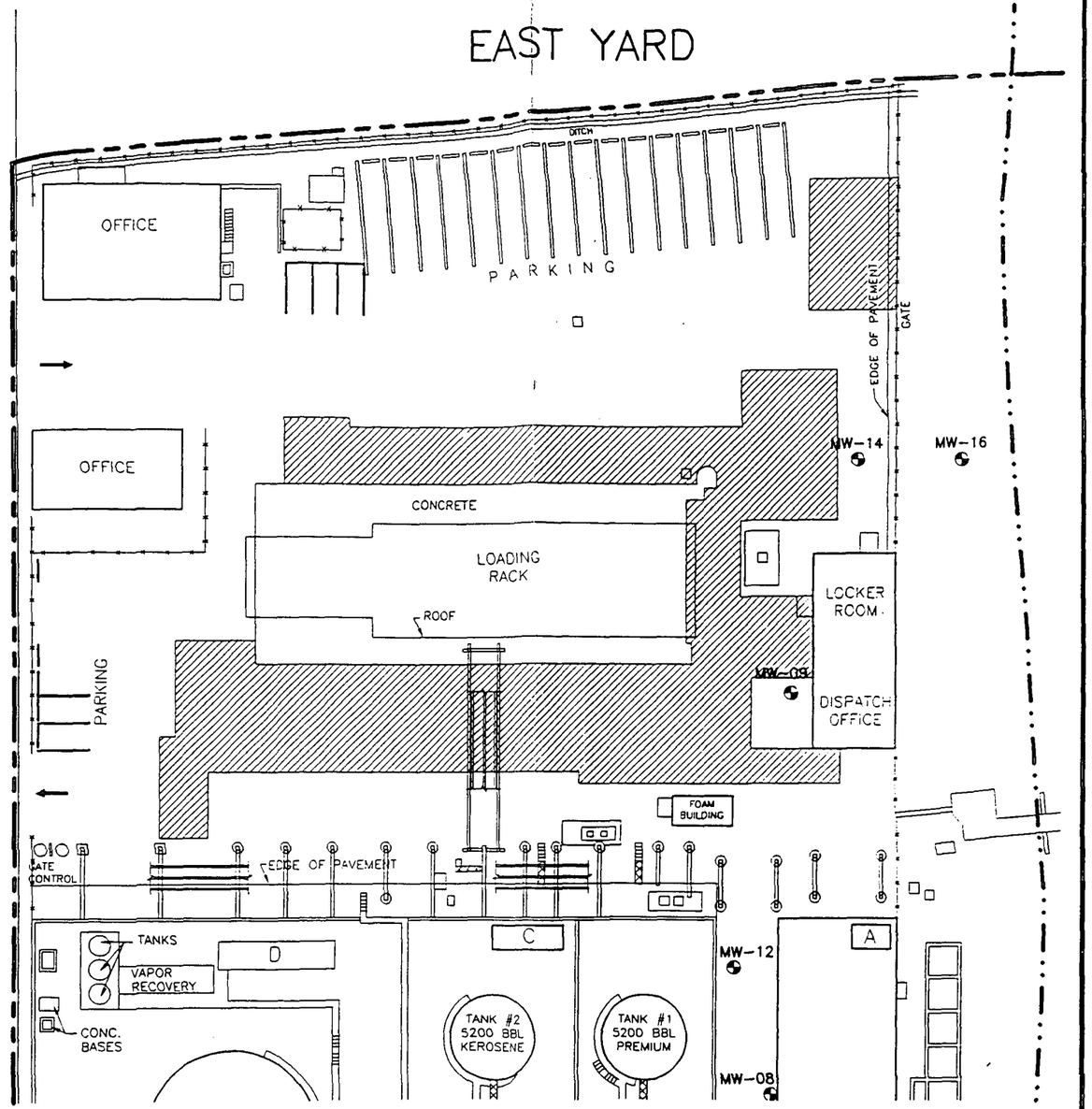
Summary

A. Delineation =	$4,800
B. Remediation =	$29,040
C. Total Cost	$33,840

LS = Lump Sum



AREAS EXCEEDING NON-RESIDENTIAL SOIL CLEANUP CRITERIA



AREAS EXCEEDING RESIDENTIAL SOIL CLEANUP CRITERIA

LEGEND:

PROPERTY LINE

MONITORING WELL

25 0 25 50

SCALE OF FEET

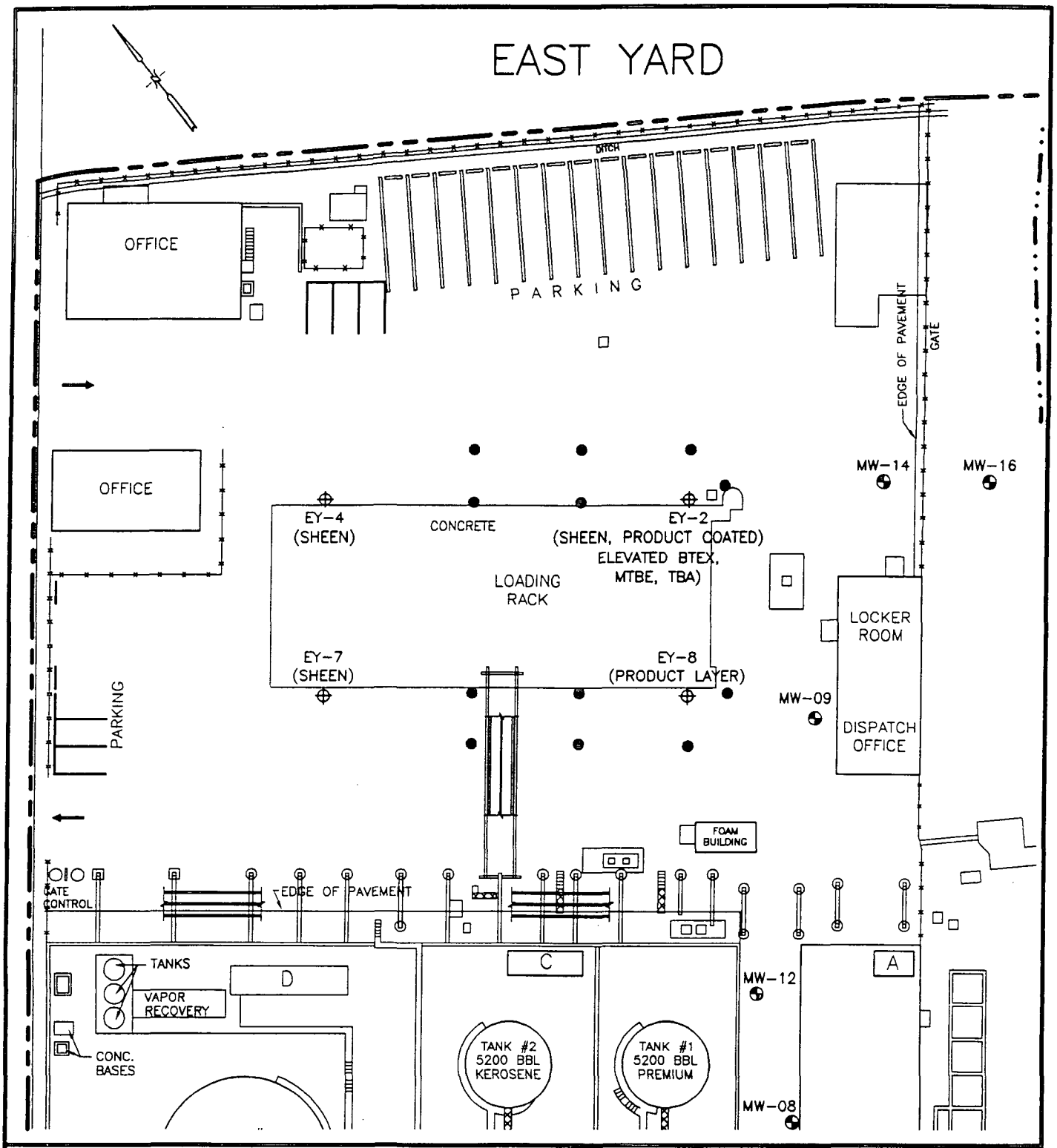
Quest Environmental & Engineering Services, Inc.
67 Beaver Avenue, Suite 26, Annandale, NJ 08801
(908)730-7707

FIGURE 2
AREAS EXCEEDING RESIDENTIAL AND NON-RESIDENTIAL CLEANUP CRITERIA

Prepared For:

TEXACO REFINING AND MARKETING INC.
BAYONNE, NEW JERSEY

CLIENT NO.	FILE NO.	CHK'D:	DRAWING NUMBER	REV. NO
11001	—	ENG.	FCONTAM	
		APP'VD.		



LEGEND:

- PROPERTY LINE
- MONITORING WELL
- PREVIOUS WELL POINT
- PROPOSED DELINEATION WELL POINT

25 0 25 50

SCALE OF FEET

Quest Environmental & Engineering Services, Inc.
1741 ROUTE 31, CLINTON, NEW JERSEY 08809
(908)730-7707

FIGURE 3
PROPOSED FREE PRODUCT DELINEATION POINTS FOR EAST YARD LOADING RACK

Prepared For:

CLIENT NO.	FILE NO.	CHK'D:	DRAWING NUMBER	REV. NO.
		ENG.	FCONT1	
		APPVD.		

932960030

3.0

3.0 Removed 1,000 Gallon No. 2 Fuel Oil UST

Description of Area of Concern, Soil Contaminants and Extent

A 1,000 gallon No. 2 Fuel Oil UST was removed from the subsurface at the site on February 21, 1997. The area around the removed 1,000 gallon No. 2 Fuel Oil UST is paved with asphalt, which is approximately 4 to 5 inches thick. The former UST was located in the East Yard of the Terminal, adjacent to the Getty Engineering and Marketing office building. Approximately 2-3 feet of fill underlies the pavement, and consists of gravel, crushed asphalt, and a mixture of sand and silt. Beneath the fill material, the natural soil consists of dark gray organic clay/silt and brown peat and sand. Ground water was encountered within the former UST excavation at approximately 2-3 feet below ground surface.

Post-excavation soil samples collected on February 21, 1997 indicated soils impacted with TPHC at levels in excess of Residential (unrestricted use) and Non-Residential (restricted use) SCC. In addition, a product 'sheen' was noted on the ground water within the former UST excavation.

Summary of Constituents Exceeding Soil Cleanup Criteria at Removed 1,000 Gallon No. 2 Fuel Oil UST AOC

Parameter	Conc. Range Exceeding SCC (mg/Kg)	Residential SCC (mg/kg)	Non-Residential SCC (mg/kg)
Total Petroleum Hydrocarbons (TPHC)	26,500 - 39,000	10,000	10,000

Additional delineation of the TPHC impacted soil around this AOC is required. Therefore, a conservative estimated volume of TPHC impacted soil to be remediated has been calculated at 75 cubic yards. In addition, as a 'sheen' was observed on the ground water during the UST removal activities, the NJDEP will likely require the installation of a groundwater monitoring well within the former UST excavation, to determine ground water quality at this location.

3.1 Delineation

As TPHC impacted soil around the former 1,000 gallon No. 2 fuel oil UST has not been adequately delineated, additional soil sampling is required by the NJDEP. The soil delineation is required regardless of which remedial alternative is selected for this AOC. As previously mentioned, a groundwater monitoring well will likely be required to be installed within this AOC to determine groundwater quality.

Soil delineation will be conducted via Geoprobe®. An estimated ten soil samples will be required to fully delineate the soil impact around this AOC. Continuous macro core soil samples will be collected from within each boring and field screened with a photoionization detector (PID), and each soil boring will be logged by a New Jersey licensed Subsurface Evaluator. The soil samples will be submitted under chain-of-custody to a New Jersey Certified Laboratory for TPHC analysis via EPA Method 418.1 (or equivalent). The costs associated with the soil delineation of this AOC are provided in Table 3-1.

As a product 'sheen' was noted within the excavation, the NJDEP will likely require the installation of a ground water monitoring well within this AOC. An NJDEP well permit will be applied for and received prior to the installation of the monitoring well. A 2-inch diameter, poly vinyl chloride (PVC) monitoring well will be installed via hollow stem auger drilling techniques, under the on-site supervision of an NJDEP Subsurface Evaluator. Drill cuttings will be field screened with a PID and each borehole will be logged. The costs associated with this well installation are provided in Table 3-1.

Estimated Additional Delineation Activities Cost: $7,000

3.2 Remediation of Soil Without Restrictions

Remediation to achieve no restrictions requires cleanup of soils to the Residential (unrestricted use) SCC. An estimated volume of soil for cleanup has been calculated at 75 cubic yards, however this volume may increase/decrease based upon analytical results for soil samples collected during additional delineation activities around this AOC. Cleanup alternatives for this AOC include soil vapor extraction, in-situ bioremediation, and excavation and off-site disposal.

An evaluation of these remedial alternatives as discussed in Section 2.1 indicated similar concerns, effectiveness, and implementability of each alternative.

Cost

The estimated costs for this remedial alternative are shown in detail in Table 3-1. Excavated material is assumed to exhibit non-hazardous waste characteristics for disposal purposes. For this estimate, it is assumed that the waste will be disposed or recycled in an approved facility. A representative cost for transportation and disposal is used in the estimate. Estimated costs are:

A. Excavation/Disposal/Engineering Costs: $32,000

3.3 Remediation of Soil with Engineering and Institutional Controls (DER)

As previously mentioned in Section 2.3, a remedial action using an engineering control to prevent exposure to the impacted soil is an applicable remedial alternative at the Terminal. This alternative would also require the implementation of institutional controls. If this remedial alternative is selected for the East Yard, soil impacted in the area of this AOC would be capped with asphalt as described in Section 2.3. The effectiveness, implementability, and maintenance associated with this remedial alternative were previously discussed in Section 2.3. In addition the associated costs, affect on ground water monitoring, and, description of the institutional control were also summarized in Section 2.3. A summary of the Soil Remedial Alternatives for the East Paved Yard, which includes the former 1,000 Gallon No. 2 Fuel Oil UST AOC was provided in Section 2.4.

Table 3-1 Preliminary Estimate of Costs For
Excavation and Off-Site Disposal UnRestricted Use
Removed 1,000 Gallon No. 2 Fuel Oil UST - East Yard - Getty Newark Terminal

A. Delineation

ITEM	Description	Quantity	Unit Cost	Total
1	Geoprobe Soil Sampling			
	+Geoprobe/Operator	1 day	$1200 / day	$1,200
	+General Mobilization	LS	$100	$100
	+Materials	LS	$120	$120
2	Oversight and Sampling	LS	$750	$750
3	Laboratory Analysis			
	+TPHC	10 smp	$45 / smp	$450
4	Well Installation			
	+General Mobilization	LS	$100	$100
	+Drill Rig	1 day	$1950 / day	$1,950
	+Well Materials/Permit	1 ea	$550 / per well	$550
5	Oversight	LS	$670	$670
6	Project Coordination/Management/Data Evaluation/Report	LS	$850	$850
7	TOTAL COST			$6,740

B. Construction/Engineering

ITEM	Description	Quantity	Unit Cost	Total
1	Mobilization/Demobilization			
	+General Mobilization	LS	$1,500	$1,500
	+Decontamination Station	LS	$2,000	$2,000
2	Site Preparation			
	+Erosion Control Measures	140 L.Ft	$6.00 / LFt.	$840
	+Storm Water Control Measures	LS	$400	$400
3	Soil Excavation			
	+Crew Chief	20 hrs	$67.00 / hr	$1,340
	+Second Man	20 hrs	$46.00 / hr	$920
	+Field Laborer	20 hrs	$37.00 / hr	$740
	+Equipment (Excavator)	LS	$1,500	$1,500
	+Backfill	110 tons	$13.00 / ton	$1,430
	+Asphalt	130 sq yd	$40 / sq yd	$5,200
	+Non-Hazardous Disposal	110 tons	$55 / ton	$6,050
	+Sample Analysis (Postex. and TCLP)	LS	$4,500	$4,500
4	DIRECT COST SUBTOTAL			$26,420
5	Pre-Design Investigation, Engineering, Design		3%	$793
6	Construction Oversight and Post-Ex Sampling		7%	$1,849
7	Contigency for Additional Excavation		10%	$2,642
8	INDIRECT COST SUBTOTAL			$5,284
9	TOTAL CAPITAL COST			$31,704

Summary

A. Delineation Cost =	$7,000
B. Construction/Engineering Cost =	$32,000
TOTAL COST	$39,000

LS = Lump Sum, L. Ft = Linear Feet
sq yd = square yard, hr = hour
Notes:
(1) Total costs are rounded to the nearest $1,000.

4.0 Pump & Bleeder Valves Area

Description of Area of Concern, Soil Contaminants and Extent

As required by the NJDEP, one soil sample was collected in the vicinity of the pump and bleeder valves located to the north of basins for Tanks #1 and #3, and Tanks #2 and #4 on July 10, 1997. The area around the pumps and bleeder valves consists of gravel. Asphalt paving begins approximately ten feet to the northeast of the pumps and bleeder valves. The basin for Tanks #1 and #3 are located adjacent to the pump and bleeder valves, to the southwest. Above ground piping is present in the vicinity of the pump and bleeder valves.

Soils encountered in the vicinity of this AOC were described as black sand and gravel fill to 1.5-feet below ground surface. Ground water was encountered within this AOC at approximately 1.5-feet below ground surface.

Analytical results for a single soil sample collected on July 10, 1997 indicated soils impacted with benzene, total xylenes, and TPHC at levels in excess of Residential (unrestricted use) and Non-Residential (restricted use) SCC.

Summary of Constituents Exceeding Soil Cleanup Criteria at Pump and Bleeder Valves AOC

Parameter	Conc. Range Exceeding SCC (mg/Kg)	Residential SCC (mg/kg)	Non-Residential SCC (mg/kg)
Benzene	29.6	3	13
Total Xylenes	144.04	410	1,000
Total Petroleum Hydrocarbons (TPHC)	17,400	10,000	10,000

Additional delineation of the TPHC, benzene, and total xylenes impacted soil around this AOC is required. Based on results for soil samples collected in the area of the loading rack, impacted soil around the pumps and bleeder valves AOC has been estimated to overlap with impacted soil previously detected in the vicinity of the loading racks.

4.1 Delineation

As benzene, total xylenes, and TPHC impacted soil around the Pump and Bleeder Valves AOC has not been adequately delineated, additional soil sampling is required by the NJDEP. The soil delineation is required regardless of which remedial alternative is selected for this AOC.

Soil delineation will be conducted via Geoprobe® beneath the asphalt in this area, and hand auger within the gravel area in the vicinity of this AOC. An estimated ten soil samples will be required to fully delineate the soil impact around this AOC. Continuous soil samples will be collected from within each boring and field screened with a photoionization detector (PID), and each soil boring will be logged by a New Jersey licensed Subsurface Evaluator. The soil samples will be submitted under chain-of-custody to a New Jersey Certified Laboratory for TPHC analysis via EPA Method 418.1 (or equivalent) and benzene and total xylenes via EPA Method 8020. The costs associated with the soil delineation of this AOC are provided in Table 4-1.

Estimated Additional Delineation Activities Cost: $6,000

4.2 Remediation of Soil Without Restrictions

Remediation to achieve no restrictions requires cleanup of soils to the Residential (unrestricted use) SCC. A conservative estimated volume of soil for cleanup has been calculated, as additional soil delineation is warranted around this AOC. Therefore, the volume of soil to be remediated in the vicinity of this AOC is estimated at 125 cubic yards. This estimated volume of soil impact around this AOC includes the gravel area in the vicinity of the pump and bleeder valves and extends to the southern boundary limits of impacted soil detected around the loading racks.

Cleanup alternatives for this AOC includes soil vapor extraction, in-situ bioremediation, and excavation and off-site disposal. An evaluation of these remedial alternatives as discussed in Section 2.1 indicated similar concerns, effectiveness, and implementability of each alternative.

An additional concern with soil excavation within this AOC is the excessive hand excavation which may be warranted within this AOC due to above ground structural constraints.

Cost

The estimated costs for this remedial alternative are shown in detail in Table 4-1. Excavated material is assumed to exhibit non-hazardous waste characteristics for disposal purposes. For this estimate, it is assumed that the waste will be disposed or recycled at an approved facility. A representative cost for transportation and disposal is used in the estimate. Estimated costs are:

A. Excavation/Disposal/Engineering Costs: $ 34,000

4.3 Remediation of Soil With Institutional Controls (DER)

Remediation to achieve Non-Residential (restricted use) SCC would require institutional controls and a DER restricting the area to non-residential uses. The cleanup method considered for this area is excavation and off-site disposal. The effectiveness and implementability for this remedial action is the same as discussed in Section 2.1.

Institutional Controls

If the application of a DER is selected as the remedial alternative for the East Yard, the DER will encompass any paved area affected by a release from this AOC. However, excavation (predominantly by hand) will be required to be conducted in the gravel area in the vicinity of this AOC due to above ground structural constraints, to achieve Non-Residential SCC. The estimated volume of soil to be excavated by hand is 33 cubic yards. The DER will specify the affected area, the contaminant levels remaining in the area above the Residential SCC, and restrictions to future site use.

Cost

The cost estimate for this remedial alternative is shown in Table 4-1.

Excavation/Disposal/Engineering Costs: $15,000

4.4 Remediation with Engineering and Institutional Controls (DER)

As previously mentioned in Section 2.3, a remedial action using an engineering control to prevent exposure to the impacted soil is an applicable remedial alternative at the Terminal. This alternative would also require the implementation of institutional controls. If this remedial alternative is selected for the East Yard, soil impacted in the area of this AOC would be capped with asphalt as described in Section 2.3. However, impacted soil beneath the gravel area (approximately 33 cubic yards) of this AOC would be required to be excavated (predominantly by hand) and transported off-site for disposal/recycling. The costs associated with the hand excavation and disposal have been provided in Table 4-2.

The effectiveness, implementability, and maintenance associated with this remedial alternative were previously discussed in Section 2.3. In addition the associated costs, affect on ground water monitoring, and; description of the institutional control were also summarized in Section 2.3. A summary of the Soil Remedial Alternative for the East Paved Yard, which includes the paved area around the Pump and Bleeder Valves AOC is provided in Section 2.4.

Table 4-1 Preliminary Estimate of Costs For Excavation and Off-Site Disposal UnRestricted Use Pump & Bleeder Valves - East Yard - Getty Newark Terminal

A. Delineation

ITEM	Description	Quantity	Unit Cost	Total
1	Geoprobe Soil Sampling			
	+Geoprobe/Operator	1 day	$1200 / day	$1,200
	+General Mobilization	LS	$100	$100
	+Materials	LS	$120	$120
2	Oversight and Sampling	LS	$750	$750
3	Laboratory Analysis			
	+TPHC	10 smp	$45 / smp	$450
	+Benzene, Total Xylenes	10 smp	$160 / smp	$1,600
4	Oversight	LS	$670	$670
5	Project Coordination/Management/Data Evaluation/Report	LS	$850	$850
6	TOTAL COST			$5,740

B. Construction/Engineering

ITEM	Description	Quantity	Unit Cost	Total
1	Mobilization/Demobilization			
	+General Mobilization	LS	$1,500	$1,500
	+Decontamination Station	LS	$2,000	$2,000
2	Site Preparation			
	+Erosion Control Measures	160 L.Ft	$6.00 / LFt.	$960
	+Storm Water Control Measures	LS	$400	$400
3	Soil Excavation			
	+Crew Chief	30 hrs	$67 / hr	$2,010
	+Second Man	30 hrs	$46 / hr	$1,380
	+Field Laborer	30 hrs	$37 / hr	$1,110
	+Equipment (Excavator)	LS	$1,500	$1,500
	+Backfill	185 tons	$13 / ton	$2,405
	+Asphalt	20 sq yd	$40 / sq yd	$800
	+Non-Hazardous Disposal	185 tons	$55 / ton	$10,175
	+Sample Analysis (Postex. and TCLP)	LS	$4,500	$4,500
4	DIRECT COST SUBTOTAL			$28,740
5	Pre-Design Investigation, Engineering, Design		3%	$862
6	Construction Oversight and Post-Ex Sampling		7%	$2,012
7	Contigency for Additional Excavation		10%	$2,874
8	INDIRECT COST SUBTOTAL			$5,748
9	TOTAL CAPITAL COST			$34,488

Summary

A. *Delineation Cost* =	$6,000
B. Construction/Engineering Cost =	$34,000
TOTAL COST	$40,000

LS = Lump Sum, L. Ft = Linear Feet

hr = hour, sq yd = square yard

Notes:

(1) Total costs are rounded to the nearest $1,000.

Table 4-2 Preliminary Estimate of Costs For Excavation and Off-Site Disposal Restricted Use Pump & Bleeder Valves - East Yard - Getty Newark Terminal

A. Delineation

ITEM	Description	Quantity	Unit Cost	Total
1	Geoprobe Soil Sampling			
	+Geoprobe/Operator	1 day	$1200 / day	$1,200
	+General Mobilization	LS	$100	$100
	+Materials	LS	$120	$120
2	Oversight and Sampling	LS	$750	$750
3	Laboratory Analysis			
	+TPHC	10 smp	$45 / smp	$450
	+Benzene, Total Xylenes	10 smp	$160 / smp	$1,600
4	Oversight	LS	$670	$670
5	Project Coordination/Management/Data Evaluation/Report	LS	$850	$850
6	TOTAL COST			$5,740

B. Construction/Engineering

ITEM	Description	Quantity	Unit Cost	Total
1	Mobilization/Demobilization			
	+General Mobilization	LS	$1,500	$1,500
	+Decontamination Station	LS	$2,000	$2,000
2	Site Preparation			
	+Erosion Control Measures	80 L.Ft	$6.00 / LFt.	$480
	+Storm Water Control Measures	LS	$400	$400
3	Soil Excavation			
	+Crew Chief	20 hrs	$67 / hr	$1,340
	+Second Man	20 hrs	$46 / hr	$920
	+Field Laborer	20 hrs	$37 / hr	$740
	+Backfill	48 tons	$13 / ton	$624
	+Non-Hazardous Disposal	48 tons	$55 / ton	$2,640
	+Sample Analysis (Postex. and TCLP)	LS	$2,000	$2,000
4	DIRECT COST SUBTOTAL			$12,644
5	Pre-Design Investigation, Engineering, Design		3%	$379
6	Construction Oversight and Post-Ex Sampling		7%	$885
7	Contigency for Additional Excavation		10%	$1,264
8	INDIRECT COST SUBTOTAL			$2,529
9	TOTAL CAPITAL COST			$15,173

Summary

A. Delineation Cost =	$6,000
B. Construction/Engineering Cost =	$15,000
TOTAL COST	$21,000

LS = Lump Sum, L. Ft = Linear Feet

sq yd -= square yard, hr = hour

Notes:

(1) Total costs are rounded to the nearest $1,000.

5.0

5.0 Fuel Additive Pump

Description of Area of Concern, Soil Contaminants and Extent

As required by the NJDEP, four soil samples were collected in the vicinity of the fuel additive pump located within the Tank Basin for Tanks #1 and #3 on July 10, 1997. The area around the pump consists of gravel fill. The Tank Basin is surrounded by a concrete wall, which presumably extends into the saturated zone. A 5,200 gallon premium unleaded gasoline AST and a 5,200 gallon Fuel Oil AST along with appurtenant above ground piping are present within the tank basin.

Soil encountered in this AOC were described as gray gravel fill to 0.5 feet below ground surface followed by gray medium sand, black silt and sand, and fill material to 1.5 feet below ground surface. Ground water was encountered within this AOC at approximately 1.5-feet below ground surface.

Analytical results for the soil samples collected on July 10, 1997 indicated soils impacted with benzene, ethylbenzene, and total xylenes at levels in excess of Residential (unrestricted use) and Non-Residential (restricted use) SCC.

Summary of Constituents Exceeding Soil Cleanup Criteria at Pump for Additive Tank AOC

Parameter	Conc. Range Exceeding SCC (mg/Kg)	Residential SCC (mg/kg)	Non-Residential SCC (mg/kg)
Benzene	3.01 - 6.82	3	13
Ethylbenzene	1,750	1,000	1,000
Total Xylenes	4,449	410	1,000

Additional delineation of the benzene, ethylbenzene, and total xylenes impacted soil around this AOC is required.

5.1 Delineation

As benzene, ethylbenzene, and total xylenes impacted soil around the Pump for the Additive Tank has not been adequately delineated, additional soil sampling is required by the NJDEP. The soil delineation is required regardless of which remedial alternative is selected for this AOC.

Soil delineation will be conducted via hand auger within the gravel area in the vicinity of this AOC. An estimated ten soil samples will be required to fully delineate the soil impact around this AOC. Continuous soil samples will be collected from within each boring and field screened with a photoionization detector (PID), and each soil boring will be logged by a New Jersey licensed Subsurface Evaluator. The soil samples will be submitted under chain-of-custody to a New Jersey Certified Laboratory for benzene, ethylbenzene, and total xylenes via EPA Method 8020. The costs associated with the soil delineation of this AOC are provided in Table 5-1.

Estimated Additional Delineation Activities Cost: $3,000

5.2 Remediation of Soil Without Restrictions

Remediation to achieve no restrictions requires cleanup of soils to the Residential (unrestricted use) SCC. A conservative estimated volume of soil for cleanup has been calculated, as additional soil delineation is warranted around this AOC. Therefore, the volume of soil to be remediated in the vicinity of this AOC is estimated at 22 cubic yards. This estimated volume of soil impact around this AOC includes the gravel area in the vicinity of the pump extends to the northern and western boundary limits of the Tank Basin.

Cleanup alternatives for this AOC includes in-situ bioremediation, and excavation and off-site disposal. An evaluation of these remedial alternatives as discussed in Section 2.1 indicated similar concerns, effectiveness, and implementability of each alternative. An additional concern with soil excavation within this AOC is the excessive hand excavation which may be warranted within this AOC due to above ground structural constraints, and constraints associated with placing heavy equipment within the Tank Basin.

Cost

The estimated costs for this remedial alternative are shown in detail in Table 5-1. Excavated material is assumed to exhibit non-hazardous waste characteristics for disposal purposes and to be disposed/recycled at an approved facility. A representative cost for transportation and disposal is used in the estimate. Estimated costs are:

A. Excavation/Disposal/Engineering Costs: $ 30,000

5.3 Remediation with Engineering and Institutional Controls (DER)

As previously mentioned in Section 2.3, a remedial action using an engineering control to prevent exposure to the impacted soil is an applicable remedial alternative for the East Yard of the Terminal. However, as the area within the Tank Basin which houses the pump for the additive tank is not suitable for capping, excavation within this AOC is the most viable remedial alternative.

Table 5-1 Preliminary Estimate of Costs For Excavation and Off-Site Disposal and UnRestricted Use Additive Tank Pump - East Yard - Getty Newark Terminal

A. Delineation

ITEM	Description	Quantity	Unit Cost	Total
1	Hand Auger Sampling			
	+Field Technician	8 hr	$55 / hr	$440
	+General Mobilization	LS	$100	$100
2	Laboratory Analysis			
	+Benzene, Ethylbenzene, Total Xylenes	10 smp	$160 / smp	$1,600
3	Project Coordination/Management/Data Evaluation/Report	LS	$750	$750
4	TOTAL COST			$2,890

B. Construction/Engineering

ITEM	Description	Quantity	Unit Cost	Total
1	Mobiliation/Demobilization			
	+General Mobilization	LS	$1,500	$1,500
	+Decontamination Station	LS	$2,000	$2,000
2	Site Preparation			
	+Erosion Control Measures	130 L.Ft	$6.00 / LFt.	$780
3	Soil Excavation			
	+Crew Chief	30 hrs	$67 / hr	$2,010
	+Second Man	30 hrs	$46 / hr	$1,380
	+Field Laborer	30 hrs	$37 / hr	$1,110
	+Equipment (Skid Steer, Conveyor Belt)	LS	$5,000	$5,000
	+Backfill	75 tons	$13 / ton	$1,235
	+Non-Hazardous Disposal	75 tons	$55 / ton	$5,225
	+Sample Analysis (Postex. and TCLP)	LS	$4,500	$4,500
4	DIRECT COST SUBTOTAL			$24,740
5	Pre-Design Investigation, Engineering, Design		3%	$742
6	Construction Oversight and Post-Ex Sampling		7%	$1,732
7	Contigency for Additional Excavation		10%	$2,474
8	INDIRECT COST SUBTOTAL			$4,948
9	TOTAL CAPITAL COST			$29,688

Summary

A. Delineation Cost =	$3,000
B. Construction/Engineering Cost =	$30,000
TOTAL COST	$33,000

LS = Lump Sum

L. Ft = Linear Feet

hr = hour

Notes:

(1) Total costs are rounded to the nearest $1,000.

6.0 Vapor Recovery Unit

Description of Area of Concern, Soil Contaminants and Extent

As required by the NJDEP, four soil samples were collected in the vicinity of the Vapor Recovery Unit on July 10, 1997. The area around the vapor recovery unit consists of gray gravel fill. The Vapor Recovery Unit is located within the Tank Basin which houses Tank #5, a 21,000 gallon diesel fuel AST and appurtenant above ground piping. The Tank Basin is surrounded by a concrete wall, which presumably extends into the saturated zone.

Soils encountered in this AOC were described as gray gravel fill to 0.2 feet below ground surface followed by black and brown silt and fill material to 2 feet below ground surface. Ground water was encountered within this AOC at approximately 1.75 feet below ground surface.

Analytical results for the soil samples collected on July 10, 1997 indicated soils impacted with benzene, toluene, total xylenes and TPHC at levels in excess of Residential (unrestricted use) and Non-Residential (restricted use) SCC.

Summary of Constituents Exceeding Soil Cleanup Criteria at Vapor Recovery Unit AOC

Parameter	Conc. Range Exceeding SCC (mg/Kg)	Residential SCC (mg/kg)	Non-Residential SCC (mg/kg)
Benzene	3.15 - 121	3	13
Toluene	1,860	1,000	1,000
Total Xylenes	1,222 - 3,141	410	1,000
TPHC	14,200	10,000	10,000

Additional delineation of the benzene, toluene, total xylenes, and TPHC impacted soil around this AOC is required. In addition, the NJDEP will likely require that a groundwater monitoring well be installed within this AOC.

6.1 Delineation

As benzene, toluene, total xylenes, and TPHC impacted soil around the Vapor Recovery Unit has not been adequately delineated, additional soil sampling is required by the NJDEP. The soil delineation is required regardless of which remedial alternative is selected for this AOC.

Soil delineation will be conducted via hand auger within the gravel area in the vicinity of this AOC. An estimated ten soil samples will be required to fully delineate the soil impact around this AOC. Continuous soil samples will be collected from within each boring and field screened with a photoionization detector (PID), and each soil boring will be logged by a New Jersey licensed Subsurface Evaluator. The soil samples will be submitted under chain-of-custody to a New Jersey Certified Laboratory for benzene, toluene, and total xylenes via EPA Method 8020. The costs associated with the soil delineation of this AOC are provided in Table 6-1.

As a release of gasoline was reported from the vapor recovery unit, the NJDEP will likely require the installation of a ground water monitoring well within this AOC, to determine if free product is present within this AOC. An NJDEP well permit will be applied for and received prior to the installation of the monitoring well. A 2-inch diameter, poly vinyl chloride (PVC) monitoring well will be installed via hand auger by a New Jersey licensed driller, under the on-site supervision of an NJDEP Subsurface Evaluator. Drill cuttings will be field screened with a PID and each borehole will be logged. The costs associated with this well installation are provided in Table 6-1.

Estimated Additional Delineation Activities Cost: $6,000

6.2 Remediation of Soil Without Restrictions

Remediation to achieve no restrictions requires cleanup of soils to the Residential (unrestricted use) SCC. A conservative estimated volume of soil for cleanup has been calculated, as additional soil delineation is warranted around this AOC. Therefore, the volume of soil to be remediated in the vicinity of this AOC is estimated at 75 cubic yards. This estimated volume of

soil impact around this AOC includes the gravel area in the vicinity of the Vapor Recovery Unit and extends to the northern and western boundary limits of the Tank Basin.

Cleanup alternatives for this AOC includes in-situ bioremediation, and excavation and off-site disposal. An evaluation of these remedial alternatives as discussed in Section 2.1 indicated similar concerns, effectiveness, and implementability of each alternative. An additional concern with soil excavation within this AOC is the excessive hand excavation which may be warranted within this AOC due to above ground structural constraints, and constraints associated with placing heavy equipment within the Tank Basin.

Cost

The estimated costs for this remedial alternative are shown in detail in Table 6-1. Excavated material is assumed to exhibit non-hazardous waste characteristics for disposal purposes and to be disposed/recycled at an approved facility. A representative cost for transportation and disposal is used in the estimate. Estimated costs are:

A. Excavation/Disposal/Engineering Costs: $ 33,000

6.3 Remediation with Engineering and Institutional Controls (DER)

As previously mentioned in Section 2.3, a remedial action using an engineering control to prevent exposure to the impacted soil is an applicable remedial alternative for the East Yard of the Terminal. However, as the area within the Tank Basin which houses the vapor recovery unit is not suitable for capping, excavation within this AOC is the most viable remedial alternative.

Table 6-1 Preliminary Estimate of Costs For Excavation and Off-Site Disposal UnRestricted Use Vapor Recovery Unit - East Yard - Getty Newark Terminal

A. Delineation

ITEM	Description	Quantity	Unit Cost	Total
1	Hand Auger Sampling			
	+General Mobilization	LS	$100	100.00
	+Materials	LS	$25	25.00
2	Oversight and Sampling	LS	$750	750.00
3	Laboratory Analysis			
	+TPHC	10 smp	$45 / smp	450.00
	+Benzene, Toluene, Total Xylenes	10 smp	$160 / smp	1,600.00
4	Well Installation			
	+General Mobilization	LS	$100	100.00
	+Licensed Driller	1 day	$1000 / day	1,000.00
	+Well Materials/Permit	1 ea	$550 / per well	550.00
5	Oversight	LS	$670	670.00
6	Project Coordination/Management/Data Evaluation/Report	LS	$850	850.00
7	TOTAL COST			6,095.00

B. Construction/Engineering

ITEM	Description	Quantity	Unit Cost	Total
1	Mobilization/Demobilization			
	+General Mobilization	LS	$1,500	$1,500
	+Decontamination Station	LS	$2,000	$2,000
2	Site Preparation			
	+Erosion Control Measures	140 L.Ft	$6.00 / LFt.	$840
	+Storm Water Control Measures	LS	$400	$400
3	Soil Excavation			
	+Crew Chief	40 hrs	$67 / hr	$2,680
	+Second Man	40 hrs	$46 / hr	$1,840
	+Field Laborer	40 hrs	$37 / hr	$1,480
	+Equipment (Skid Steer, Conveyor Belt)	LS	$5,000	$5,000
	+Backfill	110 tons	$13 / ton	$1,430
	+Non-Hazardous Disposal	110 tons	$55 / ton	$6,050
	+Sample Analysis (Postex. and TCLP)	LS	$4,500	$4,500
4	DIRECT COST SUBTOTAL			$27,720
5	Pre-Design Investigation, Engineering, Design		3%	$832
6	Construction Oversight and Post-Ex Sampling		7%	$1,940
7	Contigency for Additional Excavation		10%	$2,772
8	INDIRECT COST SUBTOTAL			$5,544
9	TOTAL CAPITAL COST			$33,264

Summary

A. Delineation Cost =	$6,000
B. Construction/Engineering Cost =	$33,000
TOTAL COST	$39,000

LS = Lump Sum, L. Ft = Linear Feet

sq yd = square yard, hr = hour

Notes:

(1) Total costs are rounded to the nearest $1,000.

7.0 Removed 550 Gallon Waste Oil UST

Description of Area of Concern, Soil Contaminants and Extent

A 550 gallon Waste Oil UST was removed from the subsurface at the site on February 21, 1997. The area around the removed 550 gallon Waste Oil UST is paved with asphalt, which is approximately 4 to 5 inches thick. The former UST was located in the West Yard of the Terminal, adjacent to the Automotive Repair Building. Approximately 2-3 feet of fill underlies the pavement, and consists of gravel, crushed asphalt, and a mixture of sand and silt. Beneath the fill material, the natural soil consists of dark gray organic clay/silt and brown peat and sand. Ground water was encountered within the former UST excavation at approximately 3 feet below ground surface.

Post-excavation soil samples collected on February 21, 1997 indicated soils impacted with TPHC at levels in excess of Residential (unrestricted use) and Non-Residential (restricted use) SCC. In addition, product saturated soils were observed within the former UST excavation.

Summary of Constituents Exceeding Soil Cleanup Criteria at Former 550 Gallon Waste Oil UST AOC

Parameter	Conc. Range Exceeding SCC (mg/Kg)	Residential SCC (mg/kg)	Non-Residential SCC (mg/kg)
TPHC	56,600 - 145,000	10,000	10,000

Additional delineation of the TPHC impacted soil around this AOC is required. In addition, the NJDEP will likely require that a groundwater monitoring well be installed within this AOC.

7.1 Delineation

As TPHC impacted soil around the former 550 Gallon Waste Oil UST has not been adequately delineated, additional soil sampling is required by the NJDEP. The soil delineation is required regardless of which remedial alternative is selected for this AOC.

Soil delineation will be conducted via Geoprobe. An estimated twenty soil samples will be required to fully delineate the soil impact around this AOC. Continuous macro core soil samples will be collected from within each boring and field screened with a PID, and each soil boring will be logged by a New Jersey licensed Subsurface Evaluator. The soil samples will be submitted under chain-of-custody to a New Jersey Certified Laboratory for TPHC analysis via EPA Method 418.1 (or equivalent). The costs associated with the soil delineation of this AOC are provided in Table 7-1.

As product stained soil was noted within the excavation within 2-feet of groundwater, the NJDEP will likely require the installation of a ground water monitoring well within this AOC. An NJDEP well permit will be applied for and received prior to the installation of the monitoring well. A 2-inch diameter, PVC monitoring well will be installed via hollow stem auger drilling techniques, under the on-site supervision of an NJDEP Subsurface Evaluator. Drill cuttings will be field screened with a PID and each borehole will be logged. The costs associated with this well installation are provided in Table 7-1.

Estimated Additional Delineation Activities Cost: $9,000

7.2 Remediation of Soil Without Restrictions

Remediation to achieve no restrictions requires cleanup of soils to the Residential (unrestricted use) SCC. An estimated volume of soil for cleanup has been calculated at 150 cubic yards, however this volume may increase/decrease based upon analytical results for soil samples collected during additional delineation activities around this AOC. Cleanup alternatives for this AOC include soil vapor extraction, in-situ bioremediation, and excavation and off-site disposal. An evaluation of these remedial alternatives as discussed in Section 2.1 indicated similar concerns, effectiveness, and implementability of each alternative.

Cost

The estimated costs for this remedial alternative are shown in detail in Table 7-1. Excavated material is assumed to exhibit non-hazardous waste characteristics for disposal purposes and to

be disposed/recycled at an approved facility. A representative cost for transportation and disposal is used in the estimate. Estimated costs are:

A. Excavation/Disposal/Engineering Costs: $54,000

7.3 Remediation with Engineering and Institutional Controls (DER)

As previously mentioned in Section 2.3, a remedial action using an engineering control to prevent exposure to the impacted soil is an applicable remedial alternative at the Terminal. This alternative would also require the implementation of institutional controls. If this remedial alternative is selected for the West Yard, soil impacted in the area of this AOC would be capped with asphalt as described in Section 2.3. The effectiveness, implementability, and maintenance associated with this remedial alternative were previously discussed in Section 2.3. The effect on ground water monitoring and description of the institutional control were also summarized in Section 2.3. The costs associated with this remedial alternative for the West Yard are summarized in Table 7-2. The Soil Remedial Alternative for the West Paved Yard is similar to the Soil Remedial Alternative for the East Yard which was summarized in Section 2.4.

A. Engineering/Capping/Maintenance Cost: $70,000

Table 7-1 Preliminary Estimate of Costs For Excavation and Off-Site Disposal and UnRestricted Use Removed 550 Gallon Waste Oil UST - West Yard - Getty Newark Terminal

A. Delineation

ITEM	Description	Quantity	Unit Cost	Total
1	Geoprobe Soil Sampling			
	+Geoprobe/Operator	2 day	$1200 / day	$2,400
	+General Mobilization	LS	$200	$200
	+Materials	LS	$240	$240
2	Oversight and Sampling	LS	$1,250	$1,250
3	Laboratory Analysis			
	+TPHC	20 smp	$45 / smp	$900
4	Well Installation			
	+General Mobilization	LS	$100	$100
	+Drill Rig	1 day	$1950 / day	$1,950
	+Well Materials/Permit	1 ea	$550 / per well	$550
5	Oversight	LS	$670	$670
6	Project Coordination/Management/Data Evaluation/Report	LS	$850	$850
7	TOTAL COST			$9,110

B. Construction/Engineering

ITEM	Description	Quantity	Unit Cost	Total
1	Mobilization/Demobilization			
	+General Mobilization	LS	$1,500	$1,500
	+Decontamination Station	LS	$2,000	$2,000
2	Site Preparation			
	+Erosion Control Measures	280 L.Ft	$6.00 / LFt.	$1,680
	+Storm Water Control Measures	LS	$400	$400
3	Soil Excavation			
	+Crew Chief	40 hrs	$67 / hr	$2,680
	+Second Man	40 hrs	$46 / hr	$1,840
	+Field Laborer	40 hrs	$37 / hr	$1,480
	+Equipment (Excavator)	LS	$1,500	$1,500
	+Backfill	220 tons	$13 / ton	$2,860
	+Asphalt	220 sq yd	$40 / sq yd	$8,800
	+Non-Hazardous Disposal	220 tons	$55 / ton	$12,100
	+Sample Analysis (Postex. and TCLP)	LS	$8,500	$8,500
4	DIRECT COST SUBTOTAL			$45,340
5	Pre-Design Investigation, Engineering, Design		3%	$1,360
6	Construction Oversight and Post-Ex Sampling		7%	$3,174
7	Contigency for Additional Excavation		10%	$4,534
8	INDIRECT COST SUBTOTAL			$9,068
9	TOTAL CAPITAL COST			$54,408

Summary

A. Delineation Cost =	$9,000
B. Construction/Engineering Cost =	$54,000
TOTAL COST	$63,000

LS = Lump Sum, L. Ft = Linear Feet

sq yd = square yard, hr = hour

Notes:

(1) Total costs are rounded to the nearest $1,000.

Table 7-2 Preliminary Estimate of Costs For Asphalt Cap
Removed 550 Gallon Waste Oil UST - West Yard - Getty Newark Terminal

A. Construction/Engineering

ITEM	Description	Quantity	Unit Cost	Total
1	Mobilization/Demobilization			
	+General Mobilization	LS	$5,000	$5,000
2	Site Preparation			
	+Surface Preparation (Fill-in holes)	LS	$3,000	$3,000
3	Containment			
	+Asphalt Cap Construction	700 sq yd	$40 sq / yd	$28,000
	+Raise Storm Water/Oil Collection System	LS	$8,000	$8,000
4	DIRECT COST SUBTOTAL			$44,000
5	Pre-Design Investigation, Engineering, Design		3%	$1,320
6	Construction Oversight and Post-Ex Sampling		7%	$3,080
7	Contigency for Additional Excavation		10%	$4,400
8	INDIRECT COST SUBTOTAL			$8,800
9	TOTAL CAPITAL COST			$52,800

B. Maintenance Costs

ITEM	Description	Quantity	Unit Cost	Total
1	Pavement Maintenance (30 year period)	LS	$1,000	$1,000
2	0-30 Year Present Worth Maintenance Cost			$17,000

Summary

A. Construction/Engineering Cost =	$53,000
B. 0-30 Year Present Worth Maintenance Cost =	$17,000
(Yearly O&M Cost, 0-30 Yrs)x(P/A, 4%, 0-30 Yrs)	
TOTAL COST	$70,000

LS = Lump Sum

L. Ft = Linear Feet

hr = hour

sq yd = square yard

Notes:

(1) Total costs are rounded to the nearest $1,000.

(2) Interest rate set at 7%, Inflation rate set at 3%, Net P/A set at 4%.

(3) Asphalt Cap includes tack coa, impregnated geotextile, and 2" FAC layer.

8.0 10,000 Gallon Diesel Fuel AST

Description of Area of Concern, Soil Contaminants and Extent

As required by the NJDEP, one soil sample was collected in the vicinity of the 10,000 Gallon Diesel Fuel AST on July 10, 1997. The area around this AST consists of gray gravel fill. The 10,000 Gallon Diesel Fuel AST is located in the West Yard, within the Tank Basin which houses Tank #11, a 54,000 gallon regular unleaded gasoline AST and appurtenant above ground piping. The Tank Basin is surrounded by a concrete wall, which presumably extends into the saturated zone.

Soil encountered in this AOC were described as gray gravel fill to 0.2 feet below ground surface followed by medium brown sand to 2 feet below ground surface. Ground water was encountered within this AOC at approximately 2 feet below ground surface.

Analytical results for the soil sample collected on July 10, 1997 indicated soils impacted with TPHC at levels in excess of Residential (unrestricted use) and Non-Residential (restricted use) SCC.

Summary of Constituents Exceeding Soil Cleanup Criteria at Vapor Recovery Unit AOC

Parameter	Conc. Range Exceeding SCC (mg/Kg)	Residential SCC (mg/kg)	Non-Residential SCC (mg/kg)
TPHC	16,100	10,000	10,000

Additional delineation of TPHC impacted soil around this AOC is required.

8.1 Delineation

As TPHC impacted soil around the Diesel Fuel AST has not been adequately delineated, additional soil sampling is required by the NJDEP. The soil delineation is required regardless of which remedial alternative is selected for this AOC.

Soil delineation will be conducted via hand auger within the gravel area in the vicinity of this AOC. An estimated ten soil samples will be required to fully delineate the soil impact around this AOC. Continuous soil samples will be collected from within each boring and field screened with a photoionization detector (PID), and each soil boring will be logged by a New Jersey licensed Subsurface Evaluator. The soil samples will be submitted under chain-of-custody to a New Jersey Certified Laboratory TPHC via EPA Method 418.1 (or equivalent). The costs associated with the soil delineation of this AOC are provided in Table 8-1.

Estimated Additional Delineation Activities Cost: $2,000

8.2 Remediation of Soil Without Restrictions

Remediation to achieve no restrictions requires cleanup of soils to the Residential (unrestricted use) SCC. A conservative estimated volume of soil for cleanup has been calculated, as additional soil delineation is warranted around this AOC. Therefore, the volume of soil to be remediated in the vicinity of this AOC is estimated at 20 cubic yards. This estimated volume of soil impact around this AOC includes the gravel area in the vicinity of the Diesel Fuel AST and extends to the northern and eastern boundary limits of the Tank Basin.

Cleanup alternatives for this AOC include in-situ bioremediation, and excavation and off-site disposal. An evaluation of these remedial alternatives as discussed in Section 2.1 indicated similar concerns, effectiveness, and implementability of each alternative. An additional concern with soil excavation within this AOC is the excessive hand excavation which may be warranted within this AOC due to above ground structural constraints, and constraints associated with placing heavy equipment within the Tank Basin.

Cost

The estimated costs for this remedial alternative are shown in detail in Table 8-1. Excavated material is assumed to exhibit non-hazardous waste characteristics for disposal purposes. For this estimate, it is assumed that the waste will be disposed/recycled at an approved facility. A representative cost for transportation and disposal is used in the estimate. Estimated costs are:

A. Excavation/Disposal/Engineering Costs = $16,000

8.3 Remediation with Engineering and Institutional Controls (DER)

As previously mentioned in Section 7.4, a remedial action using an engineering control to prevent exposure to the impacted soil is an applicable remedial alternative for the West Yard of the Terminal. However, as the area within the Tank Basin which houses the pump for the additive tank is not suitable for capping. Excavation within this AOC is the most viable remedial alternative.

Table 8-1 Preliminary Estimate of Costs For
Excavation and Off-Site Disposal and UnRestricted Use
10,000 Gallon Diesel Fuel AST - West Yard - Getty Newark Terminal

A. Delineation

ITEM	Description	Quantity	Unit Cost	Total
1	Hand Auger Sampling			
	+Field Technician	8 hr	$55 / hr	$440
	+General Mobilization	LS	$100	$100
2	Laboratory Analysis			
	+TPHC	10 smp	$45 / smp	$450
3	Project Coordination/Management/Data Evaluation/Report	LS	$750	$750
4	TOTAL COST			$1,740

B. Construction/Engineering

ITEM	Description	Quantity	Unit Cost	Total
1	Mobiliation/Demobilization			
	+General Mobilization	LS	$1,500	$1,500
	+Decontamination Station	LS	$2,000	$2,000
2	Site Preparation			
	+Erosion Control Measures	70 L.Ft	$6.00 / LFt	$420
3	Soil Excavation			
	+Crew Chief	20 hrs	$67 / hr	$1,340
	+Second Man	30 hrs	$46 / hr	$920
	+Field Laborer	30 hrs	$37 / hr	$740
	+Equipment (Conveyor Belt)	LS	$1,500	$1,500
	+Backfill	32 tons	$13 / ton	$416
	+Non-Hazardous Disposal	32 tons	$55 / ton	$1,760
	+Sample Analysis (Postex. and TCLP)	LS	$2,500	$2,500
4	DIRECT COST SUBTOTAL			$13,096
5	Pre-Design Investigation, Engineering, Design		3%	$393
6	Construction Oversight and Post-Ex Sampling		7%	$917
7	Contigency for Additional Excavation		10%	$1,310
8	INDIRECT COST SUBTOTAL			$2,619
9	TOTAL CAPITAL COST			$15,715

Summary

A. Delineation Cost =	$2,000
B. Construction/Engineering Cost =	$16,000
TOTAL COST	$18,000

LS = Lump Sum

L. Ft = Linear Feet

hr = hour

Notes:

(1) Total costs are rounded to the nearest $1,000.

f:\TNWK\Remedial Assessment\Table8-1

9.0 Area A

Description of Area of Concern, Soil Contaminants and Extent

Area A is approximately 2.5 acres. The ground surface is approximately 5-7 feet higher than the adjacent tank basin area to the north. The surface elevation is highest at the central portion of Area A and generally slopes to lower elevations to the northwest and southeast. Portions of Area A have been excavated during previous soil remedial activity conducted in 1990-1991 and in 1996. Approximately 3,300 cubic yards were excavated. The area is largely covered with grasses/weeds with a few trees situated in the northwestern portion and the northern boundary bordering the tank basin area. The extreme western portion of Area A contains vegetation characteristic of wetlands, although a wetland survey confirming the existence of wetlands has not been conducted to date. This area is not connected to a surface water body. Ground water ranges from approximately 3 feet to 7 feet deep and flows from west to east.

The soil in Area A is composed of approximately two to ten feet of fill material overlying natural soil that consists of dark gray organic clay/silt and brown peat/sand. The fill is composed of a mixture of sand, silt, and gravel with varying amounts of brick fragments, rocks, wood and other debris. Historic aerial photographs of the site reveal that Area A has undergone past filling activity which has raised the ground elevation relative to the adjacent West Tank Yard. Areas of greatest disturbance observed in aerial photographs (i.e. southern perimeter and central portion) encompass the areas of highest contamination by PCBs and polyaromatic hydrocarbons (PAHs). The NJDEP has acknowledged that the source of the contaminants is historical fill.

The primary contaminants of concern are PCBs and carcinogenic PAHs, namely benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)anthracene, indeno(1,2,3-cd)pyrene. The following table indicates the ranges of concentrations detected that exceed soil cleanup criteria.

Constituents of Concern Exceeding Soil Cleanup Criteria in Area A

Constituent	Concentration Range Exceeding SCC (mg/kg)	Residential SCC (mg/kg)	Non-Residential SCC (mg/kg)	Impact to GW SCC (mg/kg)
PCBs (total)	0.5-16	0.49	2	50
PAHs				
Benzo(a)pyrene	0.7-26	0.66	0.66	100
Benzo(b)fluoranthene	0.96-4.2	0.9	4	50
Benzo(k)fluoranthene	0.91-2.8	0.9	4	500
Benzo(a)anthracene	1.1-3.1	0.9	4	500
Indeno(1,2,3-cd)pyrene	0.92-1.4	0.9	4	500

Highest concentrations of PCBs are detected along the southern property boundary. Some locations within the central interior portion of Area A have indicated PCB concentrations greater than the Non-Residential SCC of 2 mg/kg. PCB concentrations appear to decrease to the north away from the southern property boundary and are generally higher in surface soil than in deeper intervals. Carcinogenic polyaromatic hydrocarbons (CaPAHs) listed in the table also exceed Non-Residential SCC. Benzo(a)pyrene (BaP) is the most strictly regulated of these CaPAHs, having Non-Residential SCC of 0.66 mg/kg. It is found to be above the Non-Residential SCC at a number of sample points across Area A. Concentrations are detected up to 4.2 mg/kg with the average concentration of detection of approximately 1.1 mg/kg. The distribution of the PAH concentrations does not follow as predictable a pattern as PCB concentrations. Levels vary from area to area and also with depth, which is characteristic of a historic fill source.

The extent of fill/soil that exceeds soil cleanup criteria is approximately 2 acres, ranging 2 – 7 feet in thickness. The estimated volume is 7,000 cubic yards. This volume is comprised entirely of historic fill.

9.1 Remediation Without Restrictions (No DER)

Treatment or removal of soil contaminants to meet Residential (unrestricted use) criteria is assumed to involve all of the remaining historic fill, which is estimated to be 7,000 cubic yards. Selection of the lowest cost treatment or removal action hinges on the likelihood

for the remedial action to effectively eliminate the soil contaminants. Table 9-1 is a screening of potential treatment/removal technologies for site organic contaminants. Treatment actions involving bioremediation are generally ineffective because PCBs and CaPAHs are inherently recalcitrant to biodegradation. Removal via extraction technologies is also in ineffective because PCBs and CaPAHs have boiling points > 300°C and have low to very low solubilities. Of those technologies that are considered to be moderately to highly effective, off-site disposal is likely most effective and lowest cost alternative. Therefore, it has been selected for the cost comparison evaluation.

Specifications

The excavation and off-site disposal alternative is assumed to consist of the following activities:

- Installation of erosion controls;
- Removal of trees and large brush;
- Excavation of 7,000 cubic yards of soil/contaminated material;
- Transportation and disposal of 7,000 cubic yards of soil/contaminated material;
- Post-excavation sampling to document adequate excavation;
- Further excavation based on the results of post-excavation sampling, if needed;
- Backfilling and grading the area with clean fill;
- Site restoration (seeding).

This alternative involves excavation of all source area contaminants (PCBs and PAHs) exceeding Non-Residential SCC and placement directly into trucks for subsequent transport to an off-site regulated landfill. After contaminated soils have been excavated, post-excavation samples will be collected and analyzed to establish and document that all contaminated material exceeding Non-Residential SCC has been removed. The excavation in all areas will be performed to native soil or to the ground water table. A construction staging and management area will be required which will include decontamination area, support zone and exclusion zones. The decontamination area will consist of decontamination pad where the trucks can be decontaminated and a contamination reduction zone for site personnel.

Excavation of 7,000 cubic yards of soil is estimated to be landfilled. Approximately 450 truck loads will be required to ship this material off site to a secured landfill. Backfilling will be accomplished with certified clean soil. The volume estimated for backfilling includes the 7,000 cubic yards estimated for excavation plus the previously removed 3,000 cubic yards of soil to restore the area to its original elevation. Final grading and seeding will be required to establish a protective vegetative cover. The final grades will match the existing surrounding contours. This remedial action can be completed in approximately three months.

Cost

Excavation and off-site disposal costs are estimated to include the excavation, transportation and disposal of 7,000 cubic yards. It is also assumed that the majority of excavated soil will be transported and disposed of as a non-hazardous solid waste. Estimated costs includes site layout, coordination, soil erosion control, excavation, transportation/disposal, post-excavation sampling, site restoration, and project management/reporting. Disposal costs are assumed for landfilling due to the presence of PCBs. Costs and the associated scope of work are presented in Table 9-2. The estimated cost is $1,241,000. There are no long term operational and maintenance costs associated with this alternative.

9.2 Soil Cap and DER

Capping will provide an engineering control that will limit exposure to PCBs and PAHs for Area A. This remedial alternative involves installation of a 2-acre soil cap that covers the contaminated fill area and application of a Declaration of Environmental Restriction (DER) describing the restricted area and specifying non-residential use. A soil cap will reduce human health exposure pathways to the soil contaminants and reduce contaminant mobility. The proposed location of the soil cap is shown in Figure 4. Prior to designing the cap, a design investigation will be performed to obtain design parameters and define exact limits of the cap.

Specifications

The soil cap will consist of:

1. A fifteen (15)-inch soil layer using a clay loam soil with sufficient hydraulic capacity to maintain moisture.
2. A three (3)-inch top soil layer, which will be seeded to promote and establish a vegetative cover for minimizing soil erosion.

Figure 5 includes a conceptual cross-section of the soil cap. The fill area will first be graded and filled as needed to provide a properly sloped base on which to construct the cap. Construction of the cap will begin with placement of the 15-inch imported soil layer and completed with the placement of the 3-inch top soil layer. The soil cap will be constructed and graded to obtain a sheet flow away from the area of concern. The protective layer above the surface of the contaminated soils will be engineered and graded to promote runoff and reduce rainwater from percolating and infiltrating through the soils. The surface will be seeded to establish a vegetative cover. Perimeter fencing will be installed following the completion of construction activities. The time to implement the remedial action including the design investigation, preparation of the

design/work plans, application and receipt of permits, and construction may be accomplished within 8 to 12 months.

Effectiveness

The 18-inch soil layer will effectively and reliably control site worker exposure to soil contaminants by greatly reducing the potential for dermal contact, ingestion, and inhalation of the soil bound contaminants. Since the contaminants of concern, PCBs and CaPAHs, are not volatile, exposure via a vapor inhalation pathway is not a concern. The cap will reduce the mobility of soil contaminants by preventing erosion and migration of the underlying soil fill. In addition, the cap will promote surface runoff and reduce the degree of surface water infiltration that is presently occurring. Reduced infiltration, however, is not a remedial design goal because PCBs and CaPAHs are hydrophobic and not readily leachable from the soil. Capping is effective on a long term basis and is protective of human health as it meets the remedial action objectives.

Maintenance

Routine inspection and maintenance of the asphalt will be required to ensure that the cap maintains its integrity. Pursuant to N.J.A.C 7:26E-6.1 (Technical Requirements), the cap is required to be re-evaluated by the property owner at a frequency determined by the NJDEP, typically every 5 years. The re-evaluation will at a minimum include a physical inspection of the cap and a review of the continued adequacy of all institutional controls.

Institutional Controls

A Declaration of Environmental Restriction (DER) will be applied to the East Yard restricting the use to Non-Residential. The DER will specify the affected area, the contaminant levels remaining in the area above the Residential and Non-Residential criteria, restrictions of future site use, and provisions on alterations, improvements and disturbances. Area A will be allowed for future industrial development pursuant to the requirements of a DER, which would require at a minimum notification to the NJDEP and repair of any cap disturbance to maintain integrity.

Cost

The capital cost associated with this alternative is approximately $305,000. The estimated cost includes detailed design, site layout, coordination, soil erosion control, soil grading, construction of reinforced soil cap, site restoration, and project management/reporting. A 30-year present worth maintenance cost is estimated to be $52,000. Therefore, the 30-year total worth of the soil cap is $ 357,000. Table 9-3 details the estimated costs.

9.3 Soil Piles Excavated from Area A

The excavated soil and debris dumped illegally in Area A during 1996 is another concern to be addressed. The soil is staged in two piles estimated to total approximately 1,500 cubic yards in volume. The soil piles contain a substantial amount of garbage including tires, wood, concrete, metal, and other debris. The waste characteristics of the soil are not yet known.

Two options were considered for the soil. One option is off-site disposal. The other option is to use the soil as fill for Area A if a soil cap remedial alternative is selected. The latter option is further conditioned on receiving NJDEP approval. It is uncertain at this time whether the NJDEP will approve such an alternative. This option will require submittal of a Soil Reuse Proposal to the NJDEP. At a minimum, reuse will require that contaminant levels be suitable for use as fill and the waste debris be segregated from the soil. It is estimated that approximately 30% of the pile consists of waste debris. Costs for each option are detailed in Tables 9-4 and 9-5.

Off-Site Disposal		
	A. Characterization	$ 3,000
	B. Disposal	$ 156,000
	Total	$ 159,000
Fill Reuse		
	A. Characterization	$ 4,000
	B. Screening, Placement, and Waste Disposal	$ 60,000
	Total	$ 64,000

Table 9-1 Summary of Technology Screening for Area A

Technology	Effectiveness	Implementability	Cost	Retained	Basis
No Action	L	H	L	No	Not effective, no reduction in exposure or toxicity, does not allow for future use.
Institutional Controls	L	H	L	Yes	Can be used in conjunction w/ other remedial actions to allow for future use.
Engineering Controls/Containment					
• Fencing	M	H	L	Yes	Can be used as an engineering control in conjunction with other remedial action.
• Soil Cap	M	H	L	Yes	Effective at reducing exposure and allows for future site use in conjunction with institutional controls. Unit cost range = $15 – $20/sq yd
• Asphalt / Concrete Cap	M	M	M	No	Although effective at reducing exposure, is generally more costly and is less easily to implement. May require more long term maintainenance than soil cap. Asphalt/concrete is currently not a practical application for Area A. Unit cost range = $20 – $25/ sq yd
• Composite Cap	H	M	M	Yes	Effective at reducing exposure, effective at protection of ground water . Unit cost range = $30 – $40/sq yd
Treatment (On-Site)					
• Thermal Stripping/Incineration	H	L	VH	No	Although effective at removing PCBs and PAHs, cost is high, and likely is difficult to implement due to permitting requirements and handling of fill material. Unit cost range = $200 – 500/ cy
• *In-situ* Bioremediation	L	M	L	No	Not readily effective at degrading co-mingled PCBs and four-ring or higher PAHs (e.g. benzo(a)pyrene). Unit cost range = $25 - $50/cy
• Soil Washing	M	L	H	No	Effectiveness is difficult to predict without treatability studies, and is relatively more complex to implement . Cost is high compared to other effective treatment actions. Unit cost range = $150 - $300/cy
• *In-situ* Vapor Extraction	L	M	M	No	Not effective at removing PCBs and PAHs.
• Bioventing	L	M	L-M	No	Not effective at degrading PCBs and PAHs.
• Solidification/ Stabilization	M	M	M-H	No	Can be effective at reducing exposure, however cost can be high. Unit cost range = $100 – $300/cy
Disposal (Off-Site)					
• Off-site Disposal (Non-Hazardous)	H	H	M	Yes	Is effective at removing toxicity, cost is moderate compared to the listed effective treatment actions if material is classified as non-hazardous. Unit Cost = $90 – $140/cy.

Table 9-2 **Preliminary Estimate of Capital and O&M Costs For Excavation and Off-Site Disposal Area A - Getty Newark Terminal**

Capital Costs

ITEM	Description	Quantity		Unit Cost	Total
1	Mobilization/Demobilization				$8,000
	+ General Mobilization	LS		$5,000	
	+ Decontamination Facilities	LS		$2,000	
	+ Support Facilities	LS		$1,000	
2	Site Preparation				
	+ Erosion Control Measures	1500	L. Ft	$6.00 /L.Ft	$9,000
	+ Storm Water Control Measures	LS		$2,000	$2,000
3	Soil Excavation, Consolidation and Cap				
	+ Excavation	7000	cy	$5.50 / cy	$38,500
	+ Sample Analysis (Postex. and TCLP)	LS		$22,000	$22,000
	+ Clean Backfill and Grading	10000		$21 / cy	$210,000
	+ Non-hazardous disposal	10300	Tons	$70 / Ton	$721,000
	+ Storm Water Management System Construction	LS		$20,000	$20,000
4	DIRECT COST SUBTOTAL				$1,030,500
5	Preparation of Closure Report / Meetings	LS		$25,000	$25,000
6	Pre-Design Investigation, Engineering, Design			3%	$30,915
7	QA / QC and Construction			5%	$51,525
8	Contingency			10%	$103,050
9	INDIRECT COST SUBTOTAL				$210,490
10	TOTAL CAPITAL COST				$1,241,000

No O&M Costs

TOTAL 30 YEAR PRESENT WORTH

Capital Cost =	$1,241,000
Yearly O & M is $0/yr. (0 - 30 Years)	
0 - 30 Year Present Worth O & M Cost = (Yearly O & M Cost, 0 - 30 Yrs)x(P/A, 4%, 0 - 30 Yrs)	$0
TOTAL PRESENT WORTH	$1,241,000

LS = Lump Sum
L. Ft = Linear Feet
CY = Cubic Yard

Notes:
(1) Total costs (Capital, O & M, Present Worth) are rounded to the nearest $1,000.
(2) Interest rate set at 7%, Inflation rate set at 3%, Net P/A set at 4%.
(3) Ground water monitoring not included.

Table 9-3 **Preliminary Estimate of Capital Costs and Operation and Maintenance for a Soil Cap Area A - Getty Newark Terminal**

Capital Costs

ITEM	Description	Quantity		Unit Cost		Total
1	Mobilization/Demobilization					$15,000
	+ General Mobilization	LS		$10,000		
	+ Decontamination Facilities	LS		$2,000		
	+ Support Facilities	LS		$3,000		
2	Site Preparation					
	+ Erosion Control Measures	1800	L. Ft	$6.00	/L.Ft	$10,800
	+ Storm Water Control Measures	LS		$2,000		$2,000
3	Construction					
	+ Soil Cap Construction (2 acres)	88600	Sq Ft	$1.35	/Sq Ft	$119,610
	+ Storm Water Management System Construction	LS		$20,000		$20,000
4	Backfill and Site Restoration	LS		$25,000		$25,000
5	Institutional Controls (Preparation, review, recording DER)	LS		$15,000		$15,000
6	DIRECT COST SUBTOTAL					$207,410
7	Permit Applications, Closure Report, Meetings	LS		$25,000		$25,000
8	Pre-Design Investigation, Engineering, Design, Workplan			18%		$37,334
9	QA / QC and Construction Oversight			7%		$14,519
10	Contingency			10%		$20,741
11	INDIRECT COST SUBTOTAL					$97,594
12	TOTAL CAPITAL COST					$305,000

O&M Costs

ITEM	Description	Quantity		Unit Cost		Annual Cost
	OPERATIONAL PERIOD (YEARS)	0-30 yr				
1	Fence Maintenance (30 yr period)	LS		$500		$500
2	Cap Repair (30 year period)	LS		$1,000		$1,000
3	Lawn Care (30 year period)	8	Prds	$200	/Prd	$1,600
4	TOTAL O & M COST					$3,000

TOTAL 30 YEAR PRESENT WORTH

Capital Cost =	$305,000
Yearly O & M is $3,000/yr. (0 - 10 Years) (11 - 30 Years)	
0 - 30 Year Present Worth O & M Cost = (Yearly O & M Cost, 0 - 30 Yrs)x(P/A, 4%, 0 - 30 Yrs)	$52,000
TOTAL PRESENT WORTH	$357,000

LS = Lump Sum
L. Ft = Linear Feet
Sq Ft = Square Feet
Prds = Periods

Notes:
(1) Total costs (Capital, O & M, Present Worth) are rounded to the nearest $1,000.
(2) Interest rate set at 7%, Inflation rate set at 3%, Net P/A set at 4%
(3) Ground water monitoring not included.
(4) Soil cap includes 15-inches of soil fill plus 3 inches of top soil.

Table 9-4 Preliminary Estimate of Costs For
Off-Site Disposal
Soil/Debris Stock Piles - West Yard - Getty Newark Terminal

A. Waste Characterization

ITEM	Description	Quantity	Unit Cost	Total
1	Hand Auger Sampling			
	+Field Technician	8 hr	$55 / hr	$440
	+General Mobilization	LS	$100	$100
2	Laboratory Analysis			
	+Waste Classification	LS	$2,000	$2,000
3	*Project Coordination/Management/Data Evaluation/Report*	LS	$250	$250
4	TOTAL COST			$2,790

B. Off-Site Disposal

ITEM	Description	Quantity	Unit Cost	Total
1	Mobiliation/Demobilization			
	+General Mobilization	LS	$1,500	$1,500
	+Decontamination Station	LS	$2,000	$2,000
2	Soil Excavation			
	+Crew Chief	70 hrs	$67 / hr	$4,690
	+Second Man	70 hrs	$46 / hr	$3,220
	+Equipment (Excavator)	LS	$3,000	$3,000
	+Non-Hazardous Disposal	2175	$55 / ton	$119,625
	+Roll Off	LS	$200	$200
	+Garbage Disposal	LS	$5,000	$5,000
3	DIRECT COST SUBTOTAL			$139,235
4	Coordination/Managmement/Report		2%	$2,785
5	Contigency for Additional Disposal Volume		10%	$13,924
6	INDIRECT COST SUBTOTAL			$16,708
7	TOTAL CAPITAL COST			$155,943

Summary

A. Characterization Cost =	$3,000
B. Disposal Cost =	$156,000
TOTAL COST ESTIMATE	$159,000

LS = Lump Sum

L. Ft = Linear Feet

hr = hour

Notes:

(1) Total costs are rounded to the nearest $1,000.

Table 9-5 Preliminary Estimate of Costs For
Fill Reuse
Soil/Debris Stock Piles - West Yard - Getty Newark Terminal

A. Waste Characterization

ITEM	Description	Quantity	Unit Cost	Total
1	Hand Auger Sampling			
	+Field Technician	8 hr	$55.00 / hr	$440
	+General Mobilization	LS	$100	$100
2	Laboratory Analysis			
	+Waste Classification	LS	$3,000	$3,000
3	Project Coordination/Management/Data Evaluation/Report	LS	$500	$500
4	TOTAL COST			$4,040

B. Reuse

ITEM	Description	Quantity	Unit Cost	Total
1	Mobiliation/Demobilization			
	+General Mobilization	LS	$2,000	$2,000
	+Decontamination Station	LS	$2,000	$2,000
2	Screening, Placement, and Waste Disposal			
	+Oversight ($55/hr)	LS	$2,800	$2,800
	+Equipment (Vibrating Screen)	5 days	$ 750 / day	$3,750
	+Equipment (Two Front-End Loaders)	5 days	$ 1900 / day	$9,500
	+Garbage Disposal (assume 500 tons)	500 tons	$ 60/ton	$30,000
3	DIRECT COST SUBTOTAL			$50,050
4	Soil Reuse Plan		3%	$1,502
5	Coordination, Management, and Report		7%	$3,504
6	Contingency		10%	$5,005
7	INDIRECT COST SUBTOTAL			$10,010
8	TOTAL CAPITAL COST			$60,060

Summary

A. Characterization Cost =	$4,000
B. Reuse =	$60,000
TOTAL COST ESTIMATE	$64,000

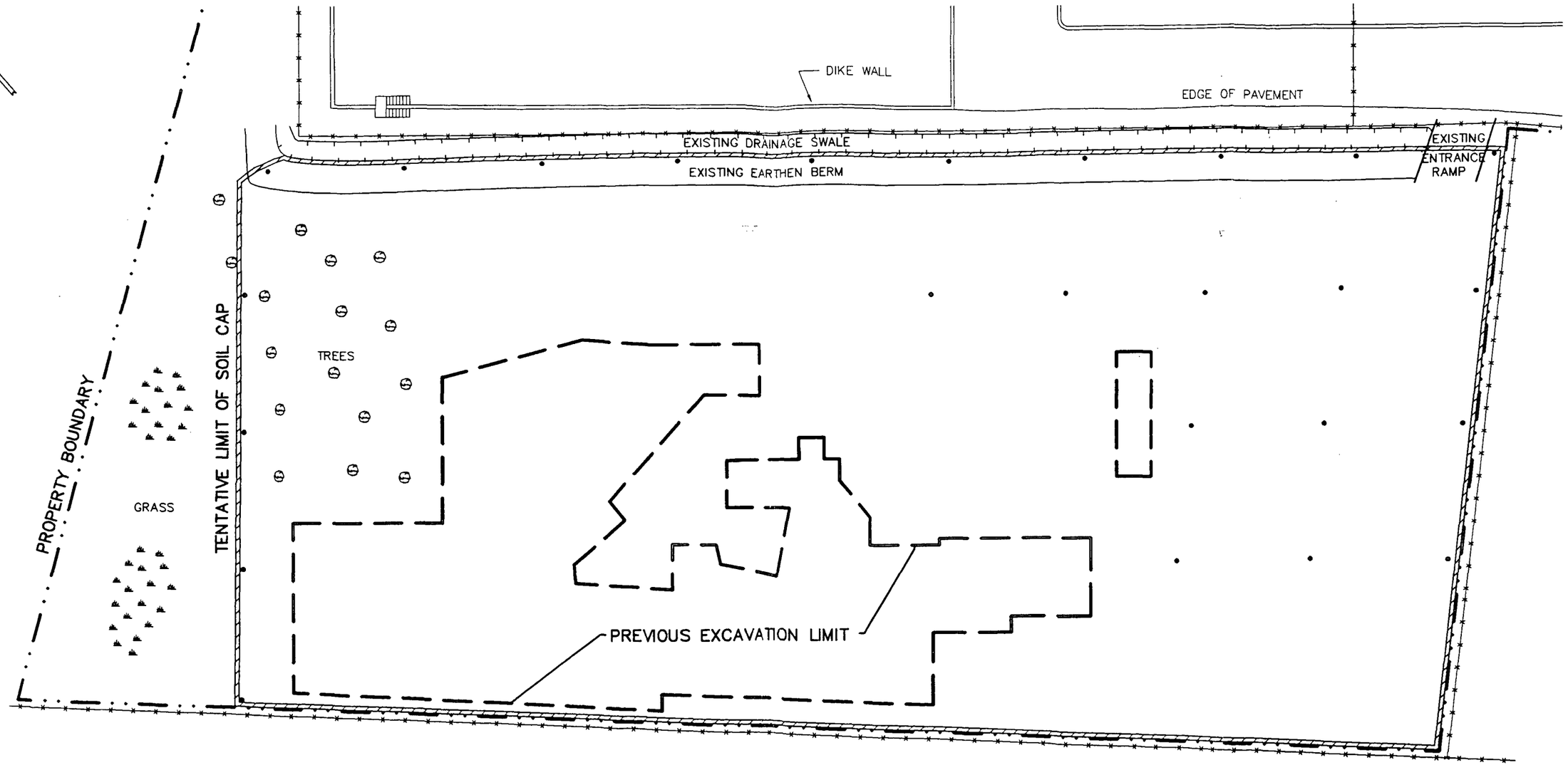
LS = Lump Sum

L. Ft = Linear Feet

hr = hour

Notes:

(1) Total costs are rounded to the nearest $1,000.



LEGEND:

- TENTATIVE LIMIT OF SOIL CAP
- PREVIOUS EXCAVATION LIMITS
- PROPOSED REMEDIAL INVESTIGATION BORING LOCATION
- PROPERTY BOUNDARY
- FENCING

20 0 20 40
SCALE OF FEET

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FIGURE 4
SOIL CAP
AREA A

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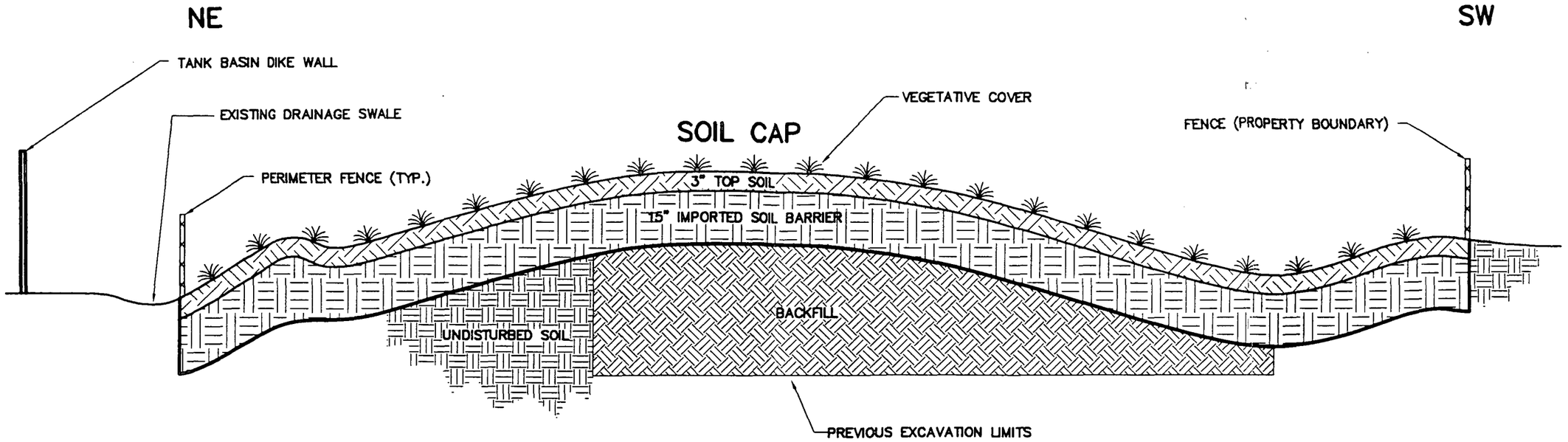
CLIENT NO.	FILE NO.	CHK'D:	DRAWING NUMBER	REV. NO.
11001	–	ENG.	FSOILCAP	
		APP'D.		



GENERALIZED CROSS SECTION

NOT TO SCALE

CONSTRUCTION SEQUENCE

1. PLACEMENT OF SOIL EROSION CONTROL MEASURES.
2. REGRADING OF SITE.
3. PLACEMENT OF SELECT SOIL FILL (AS NEEDED).
4. PREPARATION OF FINAL GRADED SURFACE.
5. PLACE 15" IMPORTED SOIL LAYER.
6. PLACE 3" TOP SOIL LAYER.
7. SEED SURFACE.
8. ERECT PERIMETER FENCE.

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FIGURE 5
SOIL CAP CROSS SECTION

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CLIENT NO.	FILE NO.	CHK'D:	DRAWING NUMBER	REV. NO.
11001	–	ENG.	FCAPSECT	
		APPVD.		

10.0

10.0 Free Product Layer in Monitoring Well MW-18

Description of Area of Concern, Contaminants, and Extent

Geoprobe sampling conducted along the West Yard northern property boundary in June 1996 revealed benzene concentrations exceeding the NJDEP Ground Water Quality Standards (GWQS). In response to this investigation, the NJDEP required installation of a monitoring well in the area of highest measured benzene concentrations. In April 1997, monitoring well MW-18 was installed to a depth of 11 feet below ground surface and sampled for VOCs, BNs, and Total Lead. The analytical results revealed detectable concentrations of BTEX (5 - 83 ug/L), MTBE (9 ug/L), total Lead (42.7 ug/L), and low concentrations (2 - 25 ug/L) of base neutrals including acenaphthene, fluorene, naphthalene, n-nitrosodiphenylamine, and phenanthrene. Measured concentrations of benzene (83 ug/L), total Lead (42.7 mg/L) and n-nitrosodiphenylamine (25 ug/L) exceeded NJDEP GWQS. No free phase product was noted during the installation or sampling of MW-18.

In August 1997, MW-18 was sampled again. This time free phase product was noted during sampling. Estimated layer thickness was approximately 1/16 of an inch. The product was easily removed and the well sampled. Similar concentrations of BTEX, MTBE, and base neutral compounds were detected, although TBA was detected during this event at a concentration of 204 ug/L.

In a written correspondence dated December 8, 1997, the NJDEP required the vertical and horizontal delineation of the contamination detected in MW-18 based on the analytical results of the April 1997 sampling. Off-site delineation may be required; however, the NJDEP allowed for resampling of the well twice during a 30-day period to confirm the presence of contamination prior to determining whether off-site delineation would be appropriate. On December 17, 1997, MW-18 was again checked for free product during the semi-annual sampling of monitoring wells. A 2- inch product layer was measured preventing adequate sampling of dissolved contamination. A sample of the product, however, was collected for finger print analysis and VOC analysis. The laboratory finger print analysis reported a matching chromatogram to a fuel oil #4 (C11-C24) standard. In addition, elevated ethylbenzene (28.4 mg/L) and total xylenes (89.7 mg/L) were detected.

The extent of free phase product in this area is not known. Previous temporary wellpoints, however, installed approximately 40 feet east and west of this location did not reveal the presence of free product. There is a possibility that the product is from an historical off-site

source even though ground water flow is off site (to the northeast) in this area. Review of an environmental data base search report and Sanborn Insurance Maps of the adjacent property has not indicated a possible source.

Free Product and Dissolved Contamination Delineation

Delineation of free product is required per the NJDEP Technical Requirements for Site Remediation (N.J.A.C. 7:26E:4.4(h)3i). Off-site delineation will also be likely required by the NJDEP. Written permission from the owner/operator to access adjacent property will be necessary. Delineation can be accomplished using small diameter wells. The decision to use small diameter monitor wells versus temporary well points, which have a 48-hr installation limit, is that the wells may be used longer than 48 hours for product monitoring and injecting/sampling.

Eight small diameter wells are proposed for delineation of free product. Figure 6 illustrates proposed locations. Wells will be installed within 20 feet and 40 feet of MW-18 at upgradient, side gradient and downgradient locations. The two downgradient points are off-site. The wells will be installed to a depth of approximately 5 feet below ground surface using a Geoprobe to minimize the amount of soil cuttings generated. A Macrocore Soil Sampler (2-inch diameter - 4 foot length) will be used to provide the borehole. The soil core collected with the Macrocore will be inspected for the presence of free phase product. A 1-inch PVC well screen with riser casing will be placed in the borehole, surrounded with sand pack and sealed at the surface with bentonite. The wells points will be checked for the presence of free product using clear bailer or electronic gauging tape immediately after installation and checked again after allowing to stand for 24-48 hours. It is also recommended that a confirmation GC-finger print sample analysis of the free product be performed as well as a finger print analysis from an off-site well point if free product also exists off site.

To satisfy the NJDEP's requirement of horizontal and vertical delineation of dissolved contamination, it is recommended that the nearest upgradient well point and downgradient well point be sampled for dissolved benzene, assuming that no free product is present. Benzene was the only dissolved contaminant, excluding total lead, that exceeded NJDEP GWQS during the August 1997 sampling event. The two previous side gradient well points (WY-4 and WY-5) delineate the dissolved benzene concentrations in these directions. In addition, it is recommended that one deep Geoprobe water sample for benzene analysis be collected at a depth between 15 - 20 feet near MW-18 to address the required vertical delineation.

Free Product Remediation

If an off-site source for the free product can be documented, then Texaco/Getty should not be responsible for remediation per NJDEP Technical Requirement (N.J.A.C. 7:26E-3.7(f). However, the NJDEP may still question the source of dissolved BTEX contamination, which may be more difficult document as an off-site source given that dissolved BTEX plumes exist within the West Yard. If an off-site source cannot be documented, then Texaco/Getty will be responsible for remediation.

The extent of free product in this area has not yet been delineated, therefore it is difficult to provide an actual scope of work and costs to remediate this area. It is suspected that the extent of free product is limited based on the results of previous well point installations along the property line and the time it took for the free product to appear in MW-18. Therefore, a remedial approach and cost estimate are provided assuming a limited extent whereby the free product occurs within a 30 ft x 40 ft area surrounding MW-18 with some off-site migration. The free product also is assumed to be restricted to the fill layer, which is more permeable than the underlying natural soils. The objectives for the remediation are:

1. To remove both mobile and residual free product from the water table and smear zone (capillary fringe). Allowing residual free product to remain will provide a source of dissolved contamination to ground water that will continue to migrate off-site.

2. To minimize the generation and subsequent treatment or disposal of groundwater and soil.

3. To accomplish the remediation within a relatively short time frame (~3 to 6 months).

As with the Loading Rack, a surfactant enhanced recovery plan is recommended. The scope of the remediation involves a surfactant injection via well to emulsify and desorb the hydrocarbons. Product and impacted ground water will be recovered and disposed off-site. To minimize any remaining LNAPL not recovered as well as dissolved contaminant from migrating further off-site, it is recommended that nutrients and an oxygen enhancing substance such as ORC be injected into the well points to enhance biodegradation of the remaining hydrocarbons. Monitoring of MW-18, an off-site well and upgradient well, will be conducted for three months to evaluate the effectiveness of treatment.

The following details the remediation steps.

1. Injection Wells and Permits

All or most of the wells installed during the delineation will be used as injection points. A Permit-By-Rule authorization and SVE pilot test approval will be obtained.

2. Surfactant Injection and Recovery

A dilute solution of surfactant (e.g. BioSolve®) will be injected in wells and in MW-18. The injection points will be surge blocked to ensure adequate distribution of the surfactant solution. After approximately 18-24 hours, recovery of product and impacted ground water will be conducted employing a vacuum truck for approximately 8 hours. A second injection and recovery will be also be conducted. Additional temporary injection points may be needed if the initial injection does not completely cover the free product area. It is assumed that up to 2,000 gallons of oil/ground water will be collected.

3. ORC and Fertilizer Addition.

Following recovery, a dilute slurry of ORC and a solution of 5:1 fertilizer will be added using a Geoprobe ORC Injection System to stimulate the natural bacterial to biodegrade the dissolved contaminants. The ORC and fertilizer will be added to each injection point, excluding MW-18, the upgradient monitoring well, and the furthest downgradient well.

4. Monitoring

Ground water will be monitored for dissolved contaminants and the injection constituents. Prior to the ORC and fertilizer addition, MW-18, the farthest upgradient well point, and the furthest downgradient well point will be sampled for volatile organic compounds (VO+10), surfactant agents (methylene blue active substances), dissolved oxygen, total nitrogen, ammonium, nitrate, and orthophosphate. The wells will be sampled one month and two months thereafter.

5. Abandonment

Following successful cleanup of the area, the small diameter wells proposed for abandonment. MW-18 will remain as a monitoring point in accordance with the semi-annual monitoring program.

Cost

The following provides an estimated cost for delineation and remediation including project management and coordination, application for a permit-by-rule authorization, work plan preparation, and area of concern closure report.

A. Delineation/Sampling	$ 6,800
B. Remediation/Monitoring	$ 18,700
C. Project Management/Report	$ 5,500
Total Cost	$ 31,000

Table 10-1 Preliminary Estimate of Costs For MW-18 Free Product Delineation and Remediation West Yard - Getty Newark Terminal

A. Delineation

ITEM	Description	Quantity		Unit Cost	Total
1	Geoprobe Well Installation and Construction				$4,200
	+ General Mobilization	LS		$100	
	+ Geoprobe/Operator	1	day	$1,200 / day	
	+ Materials and Grouting	LS		$1,900	
	+ Permits	8	permits	$75 each	
	+ Bollards	LS		$400	
2	Oversight and Sampling	LS		$1,170	$1,170
3	Laboratory Analysis				
	+ Benzene	3	smp	$60.00 / smp	$180
	+ Fingerprint Analysis	2	smp	$125.00 / smp	$250
4	Project Coordination/Management/Data Evaluation	LS		$1,000	$1,000
5	TOTAL COST				$6,800

B. Remediation

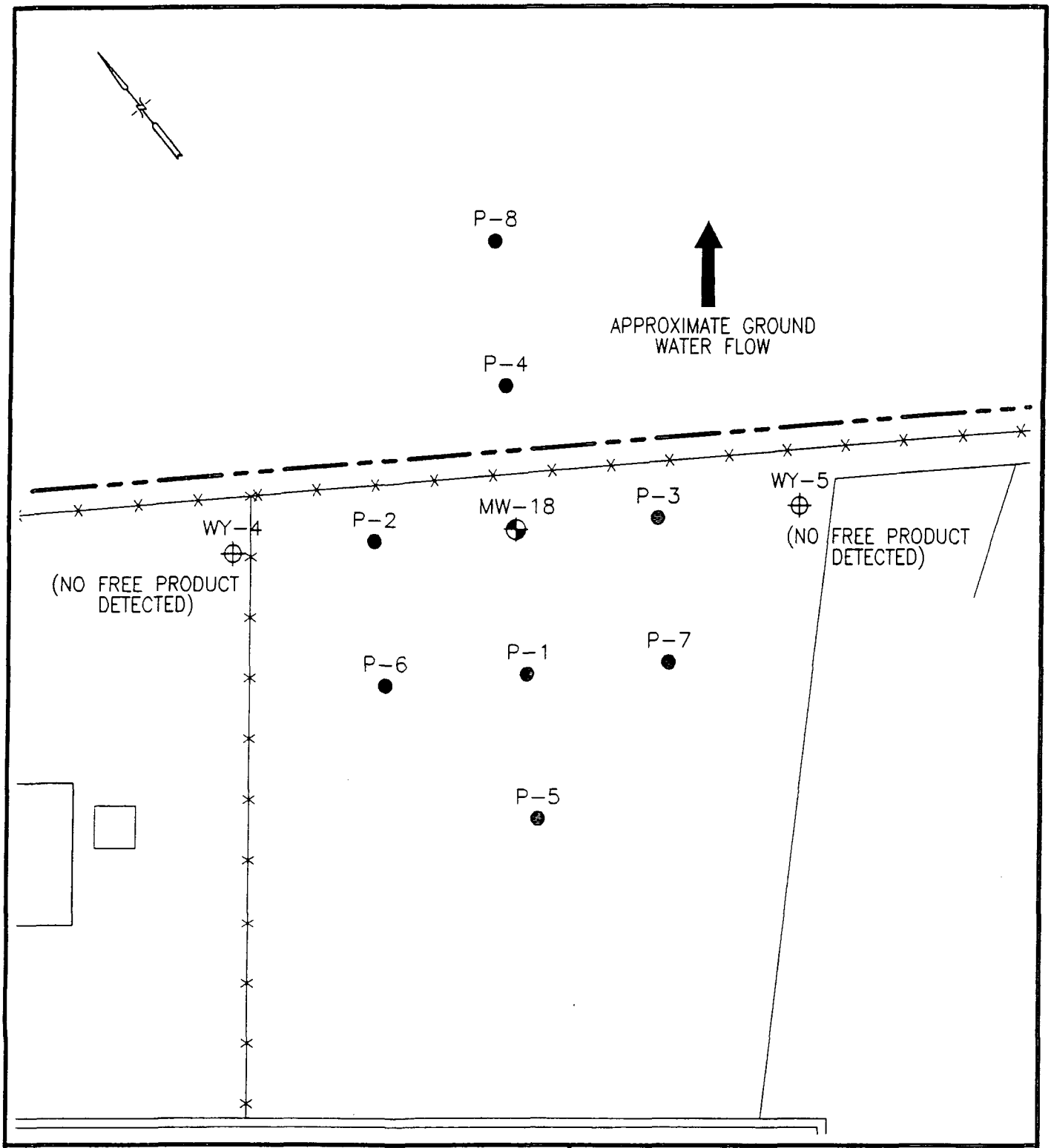
ITEM	Description	Quantity		Unit Cost	Total
1	Permit by Rule and SVE Pilot Test Applications and Fee	1	LS	$700	$700
2	Surfactant Injection (2 events)				
	+ Geologist ($55/hr) & Field Tech. $ (40/hr) - 2 days	2	events	$800 / event	$1,600
	+ Field Vehicle and Equipment	2	events	$175 / event	$350
	+ Materials (Biosolve, drum, tubing, etc)	2	events	$425 /event	$850
				Subtotal	$2,800
3	Product Recovery (2 events), Disposal, Baseline Sampling				
	+ Geologist ($55/hr)	2	events	$575 /event	$1,150
	+ Vac Truck and Operator	2	events	$1,150 /event	$2,300
	+ Recovered Oil/ Water Disposal	2000	gals	1.05 / gal	$2,100
	+ SVE Pilot Test Application and Fee	1	LS	$520	$520
	+ Equipment and Materials (Field Vehicle, Fittings, tubing)	2	events	$300 /event	$600
	+ Analytical (VO+10=$195, MBAS=$40, N=$55, P=$20	3	samples	$310 / samp	$930
				Subtotal	$7,600
4	ORC/Fertilizer Addition				
	+ Geologist ($55/hr)	1	day	$500 / day	$500
	+ Geoprobe ORC Injection System	1	day	$1,400 / day	$1,400
	+ Field Vehicle and Materials (60 lb ORC, Fertilizer, etc)	1	LS	$1,000	$1,000
				Subtotal	$2,900
5	Monitoring (2 events)	2	events	$1,600 / event	$3,200
6	Well Abandonment	1	LS	$950	$950
7	Closure Report	1	LS	$2,300	$2,300
8	Project Coordination Management	1	LS	$2,150	$2,150
9	Contingency for additional injection points	1	LS	$1,500	$1,500
10	TOTAL COST				$24,100

Summary

A. Delineation =	$6,800
B. Remediation and Monitoring =	$24,100
C. Total Cost	$30,900

LS = Lump Sum

932960085



LEGEND:

- PROPERTY LINE
- MONITORING WELL
- PROPOSED WELL POINT
- PREVIOUS WELL POINT

10 0 10 20

SCALE OF FEET

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(908)730-7707

FIGURE 6
PROPOSED MW-18
FREE PRODUCT DELINEATION

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BAYONNE, NEW JERSEY

CLIENT NO.	FILE NO.	CHK'D:	DRAWING NUMBER	REV. NO.
		ENG.	FMW18	
		APPVD.		

11.0 Dissolved Ground Water Contamination

Contaminants of Concern and Extent

Site ground water is unconfined and under water table conditions. Figure 7 is a ground water elevation contour map of the site. Highest elevations exist in the West Yard in the vicinity of MW-15, and lowest elevations are in East Yard wells MW-14 and MW-16, which are adjacent to the Passaic River. The elevation contours indicate that ground water flows toward the northeast in the West Yard and to a more easterly direction in the East Yard. The northeast flow component in the West Yard is believed to be influenced by the existence of a drainage swale located within the center of the adjacent property to the north. Ground water appears to be flowing into this drainage swale. The hydraulic gradient of the water table is shallow, ranging from approximately 0.003 ft/ft to 0.005 ft/ft. Ground water is currently classified as Class II-A (drinking water), but is in the process of being reclassified to a Class II-B designation (regional ground water contamination).

The primary contaminants of concern for ground water are benzene and MTBE, which exceed applicable ground water quality standards in a number of wells. Concentrations near or exceeding ground water quality standards have been measured in West Yard Wells MW-3, MW-4, MW-5, MW-11, and MW-18 and in East Yard Wells MW-7, MW-8, MW-9, and MW-12. Secondary contaminants of concern include a base neutral compound, n-nitrosodiphenylamine, which historically has been detected in West Yard wells MW-4 and MW-13, and chlorobenzene which has been detected in MW-3. The sources of these contaminants are not known.

The NJDEP has not required active ground water remediation to date, but has established that the need for active remediation be considered if the furthest downgradient well, MW-16, exhibits concentrations that exceed the Surface Water Quality Criteria. So far, measured concentrations of regulated contaminants, including benzene, toluene, and ethylbenzene, in MW-16 have been much less than Surface Water Quality Criteria. Therefore, there has been no need to consider active ground water remediation for dissolved contamination. Continued ground water monitoring, however, will be required, regardless of the soil remedial alternatives selected for the identified areas of concern.

Objective

The objective for addressing dissolved ground water contamination is to demonstrate that dissolved ground water concentrations are decreasing via natural degradation processes at each area of concern where ground water contamination exists and where sources have been

identified. Once decreasing trends can be documented via NJDEP technical requirements, then proposals toward closing ground water AOCs can be made.

The NJDEP has established natural remediation as a viable remedial action for ground water. When proposing a natural remediation plan, it must be demonstrated that ground water contaminant concentrations will decrease to the applicable ground water or surface water criteria through degradation, retardation, or dispersion under present site conditions. Generally, site data and ground water modeling are used to predict the period of time when dissolved contaminants will decrease to the applicable standards. No further action is approved once contaminant levels in source area monitoring wells and downgradient plume monitoring wells are at or below applicable standards for two consecutive monitoring events.

As part of this remedial approach, the NJDEP generally requires the establishment of a Classification Exception Area (CEA). A CEA consists of a written and mapped description of the area where constituent concentrations do not meet applicable standards (essentially the boundaries of dissolved ground water plume). Designated aquifer uses are suspended within the CEA until natural remediation is expected to reduce contaminant levels to applicable standards and no further action is approved. Suspension of ground water uses are not a concern for this site since ground water is not used. Even though site ground water is not used as a source of drinking water and ground water throughout much of Newark will be reclassified to a Class IIB designation (regional ground water contamination), NJDEP still requires a CEA because they make no distinction between Class II-A and probable future Class II-B areas in deciding whether a CEA is needed. At least two CEA's are known to have been approved along Doremus Avenue. One exists at the former Chemical Waste Management Site at 41-85 Doremus Avenue, and the other exists at Essex Industrial Chemicals at 351 Doremus Avenue.

Natural Remediation Plan

A natural remediation plan is recommended for this site. The natural remediation plan will include the following:

- an evaluation of site conditions necessary to support biodegradation, retardation, and dispersion (e.g., bioremediation parameters, physical and chemical characteristics of the contaminants, and aquifer characteristics);

- delineation and fate of the contaminant plume;

- results of a ground water flow/contaminant model (e.g. BioPlume II) predicting contaminant concentrations at downgradient wells over time;

- a ground water monitoring plan to track natural attenuation.

Additional information will be needed to prepare the natural remediation plan. Recommended activities include:

- Well sampling to establish biogeochemical parameters including dissolved oxygen, pH, alkalinity, total carbon dioxide, dissolved iron, BTEX degraders, chloride, and total dissolved solids. Three wells are recommended.

- Aquifer slug tests of approximately five monitor wells to obtain hydraulic conductivity necessary to predict the rate of plume migration;

- Additional well installations to characterize source areas and delineate contaminant plume boundaries;

- Monitoring plan to monitor plume characteristics and assess the effectiveness of natural remediation.

Monitoring Wells

Six additional wells are recommended for tracking natural attenuation. Four (4) of the additional six wells were previously discussed in the remedial alternatives for the Load Rack Area, the 1,000 Gallon Fuel Oil UST, the Vapor Recovery Unit, and the 550 Gallon Waste Oil UST. These wells are shown in Figure 8 as MW-A through MW-D and represent source area wells. Wells to monitor downgradient plume characteristics and plume boundaries in large part should be satisfied by existing wells. However, two additional downgradient wells are recommended. One well, MW-E, is recommended to be located downgradient of MW-12 and MW-8, which represent source area or near source area wells for the Fuel Additive Tank area. A tentative location is east of the garage building near the oil/water separator. This well will define the downgradient plume boundary in this area. The other well, MW-F, is recommended to be located northeast of the Loading Rack near the property boundary. This well will serve as a side-gradient plume monitoring point, and may also serve as a downgradient point for the 1,000 gallon Fuel UST area if dissolved contamination exists in this area. In summary, the new wells include:

MW-A: Vapor Recovery Unit source area well;
MW-B: Removed 1,000 Gal. No. 2 Fuel Area UST source area well;
MW-C: Loading Rack source area well (keep one well used for surfactant injection as a long term monitoring point);
MW-D: Removed 550 Gal. Waste Oil UST source area well;
MW-E: Downgradient plume well east of MW-8/MW-12;
MW-F: Side-gradient plume well northeast of the Loading Rack and potential downgradient plume well from the 1000 gallon UST area.

It is also recommended that some existing wells be proposed for abandonment due to either historical detection of only trace to non-detectable contaminant concentrations or overlap of monitoring from a nearby well. Four (4) wells are recommended for abandonment:

MW-15: Located in Area A and has exhibited trace contaminant levels (previously approved for abandonment.

MW-5 and MW-11: These wells are located within 30-40 feet of MW-3 and overlap in monitoring the plume at this location. Therefore, only one well is necessary. MW-3 is selected for monitoring because it historically has exhibited the highest concentrations of BTEX. However, it is recommended that MW-3 be replaced because its integrity appears to have been compromised during upgrade of pavement in this area. Therefore, it may not measure dissolved contaminants that are representative of the aquifer.

MW-6: This well, which is currently under one of the soil piles in the West Yard, has shown nondetectable to trace concentrations of benzene, toluene, and xylenes. The most recent sampling of MW-6 has indicated that only a trace level of total xylenes is present. In addition, a soil area of concern or a source area is not located upgradient from MW-6, requiring that it remain as a monitoring point.

Monitoring Plan

A tentative monitoring plan for natural remediation is provided below. Typically, the NJDEP requires quarterly monitoring to track natural attenuation. However, NJDEP may accept a proposal for a reduced monitoring frequency, particularly since there exists over seven years of historical semi-annual sampling data that may be used to show already decreasing contaminant concentrations trends in some areas.. For the purposes of this scenario, we have assumed that

semi-annual monitoring will be approved. We also have assumed that the semi-annual sampling will last for three years or six monitoring events. Seventeen monitoring wells are assumed for monitoring.

- East Yard

  Source Area Wells

  - MW-A (Vapor Recovery Unit)
  - MW-B (Removed 1,000 Gallon UST Area)
  - MW-C (Loading Rack Area)
  - MW-12 (Fuel Additive Tank)

  Downgradient Monitoring Wells

  - MW-7 (downgradient/side gradient plume fringe monitoring point)
  - MW-8 (downgradient plume monitoring point)
  - MW- E (downgradient plume fringe monitoring point - Fuel Additive Tank)
  - MW-9 (downgradient plume monitoring point - Loading Rack Area/Vapor Recovery Unit)
  - MW-14 (downgradient plume monitoring point - Loading Rack Area)
  - MW-16 (downgradient plume fringe monitoring point - Loading Rack Area)
  - MW- F (downgradient/side gradient monitoring point - Loading Rack Area and 1,000 Gal. Fuel Oil UST)

- West Yard

  Source Area Wells

  - MW-3 (area of elevated benzene of source unknown)
  - MW-4 (potential source area for n-nitrosodiphenyl amine contamination)
  - MW-D (Removed 550 Gal. Waste Oil UST)

  Downgradient Monitoring Points

  - MW-13 (downgradient point from source area wells)
  - MW-17 (downgradient plume fringe monitoring point)
  - MW-18 (downgradient boundary point used to monitor the effectiveness of free product removal and passive ground water remediation.

All wells shall be sampled for volatile organic compounds, MTBE and TBA. Four monitoring wells (MW-4, MW-13, MW-D, and MW-17) will also be sampled for base neutral compounds.

As specified previously, this monitoring plan is tentative. The actual number of monitoring points submitted with a final monitoring plan may be reduced after evaluation of the source area sampling results and ground water modeling.

Existing wells MW-1 and MW-2 are not recommended for inclusion in the monitoring plan because they previously have shown non-detectable to trace contaminant levels. However, the well locations make them useful for obtaining water level measurements necessary for documenting ground water flow across the site.

It should also be mentioned that the monitoring requirements at the Loading Rack Area may be altered if an asphalt cap is selected. A possible ground water monitoring scenario for the cap was described in Section 2.3.

Costs

Cost estimates for addressing dissolved ground water contamination are provided in Table 11-1. Activities include installation and sampling of two additional wells, sampling to evaluate site conditions, aquifer slug testing, ground water modeling, preparation of a natural remediation plan, and semi-annual sampling for three years.

A. Additional Well Installation/Natural Remediation Plan:	$30,500
B. 3-year Semi-Annual Ground Water Monitoring:	$66,000
	$96,500

Table 11-1 Preliminary Estimate of Costs For Dissolved Ground Water Natural Remediaton Plan and Monitoring Getty Newark Terminal

A. Additional Well Installation, Sampling, and Natural Remediation Plan

ITEM	Description	Quantity		Unit Cost	Total
1	Addition Well Installation and Sampling for Site Evaluation				
	+ Coordination and Oversight	LS		$1,200	$1,200
	+ Drill Rig/Crew	1	day	$1,950 / day	$1,950
	+ Monitor Wells + permits	3	wells	$500 / well	$1,500
	+ Field Sampling (Equipment, Materials, Labor)	LS		$1,575	$1,575
	+ VO+10 Analysis	3	samp	$200 / samp	$600
	+ Biogeochemical Parameters	3	samp	$290 / samp	$870
				subtotal	$7,695
2	Surveying (all new wells)	LS		$1,200	$1,200
3	Slug Testing				
	+ Field Testing	LS		$1,500	$1,500
	+ Data Evaluation	LS		$600	$600
				subtotal	$2,100
4	Ground Water Modelling	LS		7,000	$7,000
5	Natural Remediation Plan	LS		9,500	$9,500
6	Project Management	LS		3,000	$3,000
7	TOTAL COST				$30,495

B. Semi-Annual Monitoring (3 yrs)

ITEM	Description	Quantity		Unit Cost	Total
1	Field Sampling (per event - 2 field days per event)				
	+ Geologist ($55/hr) & Field Tech. $ (40/hr)	2	days	$1,100 / day	$2,200
	+ Field Vehicle and Equipment	2	days	$340 / day	$680
	+ Materials (bailers, tubing, gloves, etc)	2	days	$130 / day	$260
				subtotal	$3,140
2	Sample Analysis (per event)				
	+ VO+10, MTBE,TBA (17 wells plus 4 field and trip blanks)	21	samples	$200 /samp	$4,200
	+ BN+15 (4 wells plus 1 field blank)	5	samples	$240 /samp	$1,200
				subtotal	$5,400
3	Results Report and Project Management (per event)	1	LS	$2,300	$2,500
4	TOTAL COST (per event)				$11,040
5	TOTAL COST for 3 years (6 events)	6	events	$11,040 /event	$66,240

Summary

A. Additional Well Installation, Sampling, and Natural Remediation Plan =	$30,500
B. Semi-Annual Ground Water Monitoring =	$66,000
C. Total Cost	$96,500

LS = Lump Sum

932960094

GETTY NEWARK TERMINAL

WEST YARD

EAST YARD

NEW JERSEY TURNPIKE

DORMUS AVENUE

PASSAIC RIVER

MW-01 (4.84')
MW-02 (NM)
MW-03 (5.36')
MW-04 (5.55')
MW-05 (5.50')
MW-06 (NM)
MW-07 (4.76')
MW-08 (4.65')
MW-09 (3.34')
MW-10
MW-11 (5.25')
MW-12 (4.63')
MW-13 (4.89')
MW-14 (3.32')
MW-15 (6.77')
MW-16 (3.13')
MW-17 (3.73')
MW-18 (4.02')

4.0
4.5
5.0
5.5
6.0
6.5
3.5

TANK #10 54,000 BBL UNLEADED REGULAR
TANK #1 54,000 BBL UNLEADED REGULAR
TANK #9 34,000 BBL PREMIUM
TANK #5 21,000 BBL DIESEL
TANK #6 21,000 BBL PREMIUM
TANK #7 21,000 BBL UNLEADED REGULAR

FOAM BUILDING
AUTOMOTIVE REPAIR BLDG.
TRANSFORMER
TRANSFORMER HUT
METAL CONTROL BLDG.
DRUM STORAGE AREA
WAREHOUSE
OFFICE
PARKING
CONCRETE
ROOF
DISPATCH OFFICE
LOCKER ROOM
GARAGE
LOADING DOCK
OIL / WATER SEPARATOR
MOORING PIER
DIKE WALL
EDGE OF PAVEMENT
GRAVEL

50 0 50 100
SCALE OF FEET

LEGEND:

PROPERTY LINE

MONITOR WELL LOCATION

(6.77') WATER LEVEL ELEVATION IN FEET ABOVE M.S.L.

GROUNDWATER ELEVATION CONTOUR (M.S.L. DATUM) DASHED WHERE INFERRED

APPROXIMATE GROUNDWATER FLOW DIRECTION

Quest Environmental & Engineering Services, Inc.
1741 Route 31, Clinton, NJ 08809
(908)730-7707

FIGURE 7
GROUNDWATER CONTOUR MAP
(DECEMBER 17, 1997)

Prepared For:
TEXACO REFINING AND MARKETING INC.

CLIENT NO.	FILE NO.	CHK'D:	DRAWING NUMBER	REV. NO.
11001	–	ENG.	FGWC1297	
		APPVD.		

GETTY NEWARK TERMINAL

WEST YARD

EAST YARD

NEW JERSEY TURNPIKE

DOREMUS AVENUE

PASSAIC RIVER

MW-18 FREE PRODUCT LAYER

REMOVED 1000 GAL. NO.2 FUEL OIL UST

REMOVED 550 GAL. WASTE OIL UST

ABOVEGROUND 10,000 GAL. DIESEL TANK

LOADING RACK AREA

PUMP AND BLEEDER VALVES

VAPOR RECOVERY UNIT

FUEL ADDITIVE TANK PUMP

AREA A

MW-01 MW-02 MW-03 MW-04 MW-05 (ABANDON) MW-06 (ABANDON) MW-07 MW-08 MW-09 MW-11 (ABANDON) MW-12 MW-13 MW-14 MW-15 (ABANDON) MW-16 MW-17 MW-18 MW-A MW-B MW-C MW-D MW-E MW-F

TANK #10 54,000 BBL. UNLEADED REGULAR

TANK #11 54,000 BBL. UNLEADED REGULAR

TANK #8 21,000 BBL. NO. 2

TANK #9 54,000 BBL. PREMIUM

TANK #5 21,000 BBL. DIESEL

TANK #6 21,000 BBL. PREMIUM

TANK #7 21,000 BBL. UNLEADED REGULAR

TANK #1 6300 BBL. PREMIUM

TANK #2 6300 BBL. FUEL OIL

TANK #3 6300 BBL. KEROSENE

TANK #4 6300 BBL. KEROSENE

OFFICE

CONCRETE LOADING RACK ROOF

LOCKER ROOM

DISPATCH OFFICE

GARAGE

LOADING DOCK

OIL / WATER SEPARATOR

MOORING PIER

MOORING PIER

AUTOMOTIVE REPAIR BLDG.

WAREHOUSE

METAL CONTROL BLDG.

DRUM STORAGE AREA

TRANSFORMER HUT

TRANSFORMER

FOAM BUILDING

DIKE WALL

EDGE OF PAVEMENT

GRAVEL

CONC. SLAB & SUMPS

CONC. PUMP SUP

CONC. PULLER PAD

CONC. & STEEL PIPE RACK

6" CURBING

GATE

50 0 50 100

SCALE OF FEET

LEGEND:

PROPERTY LINE

MONITORING WELL

Quest Environmental & Engineering Services, Inc.
1741 ROUTE 31, CLINTON, NJ 08809
(908)730-7707

FIGURE 8
PROPOSED MONITORING WELLS

CLIENT NO.	FILE NO.	CHK'D:	DRAWING NUMBER	REV. NO.
11001	–	ENG.	F-MW	
		APPVD.		

12.0 Summary

Table 12 summarizes the remedial alternatives and cost estimates for each area of concern based on the assumptions described in each section. Costs for achieving no site restrictions (no DER) using treatment or removal alternatives are substantially higher than costs remediating the site with institutional and engineering controls. Approximately one-half of the total soil remediation costs are associated with Area A. Total cost estimates are summarized below:

Soil Remediation to Unrestricted Use Criteria (No DER):	$ 1,900,000 - $ 2,200,000
Soil Remediation to Restricted Use Criteria (DER) and Engineering Controls (including maintenance):	$ 650,000 - $ 700,000
Ground Water Activities including Free Product Remediation, Natural Remediation Plan, CEA, and 3-yr Semi-Annual Monitoring.	$ 160,000 - $ 165,000

Table 12-1 Summary of Remedial Alternatives and Cost Estimates
Getty Newark Terminal

Area of Concern	Institutional/Engineering Controls	Remedial Action	Cost Estimate
Loading Rack Area - Soil (East Yard)	None - Unrestricted Use	Bioventing/Biosparge System + Engineering/Construction = $ 409,000 + 3 -Year O & M = $ 301,000	$710,000
	None - Unrestricted Use	Excavation and Off-Site Disposal + Delineation = $ 22,000 + Remediation = $ 411,000	$ 430,000 - $ 600,000
	Restricted Use - DER	Excavation and Off-Site Disposal + Delineation = $ 16,000 + Remediation = $ 325,000	$ 340,000 - $ 450,000
	Restricted Use - Engineering Control - DER	Asphalt Cap + Engineering/Construction = $ 108,000 + 30-yr Maintenance Present Worth = $17,000 + Ground Water Monitoring 6 yr = $33,000	$158,000
Loading Rack Area - Product (East Yard)	Not Applicable	Surfactant Enhanced Recovery + Delineation = $ 5,000 + Remediation/Monitoring = $ 29,000	$34,000
Removed 1,000 Gallon Fuel Oil UST (East Yard)	None - Unrestricted Use	Excavation and Off-Site Disposal + Delineation = $ 7,000 + Remediation = $ 32,000	$39,000
	Restricted Use - Engineering Control - DER	Asphalt Cap	Included with Loading Rack Asphalt Cap
Pump and Bleeder Valves (East Yard)	None - Unrestricted Use	Excavation and Off-Site Disposal + Delineation = $ 6,000 + Remediation = $ 34,000	$40,000
	Restricted Use - DER	Excavation and Off-Site Disposal + Delineation = $ 6,000 + Remediation = $ 15,000	$21,000
Additive Tank Pump (East Yard)	None - Unrestricted Use	Excavation and Off-Site Disposal + Delineation = $ 3,000 + Remediation = $ 30,000	$33,000

Table 12-1 Summary of Remedial Alternatives and Cost Estimates

Getty Newark Terminal

Area of Concern	Institutional/Engineering Controls	Remedial Action	Cost Estimate
Vapor Recovery Unit (East Yard)	None - Unrestricted Use	Excavation and Off-Site Disposal + Delineation = $ 6,000 + Remediation = $ 33,000	$39,000
Removed 550 Gallon Waste Oil UST (West Yard)	None - Unrestricted Use	Excavation and Off-Site Disposal + Delineation = $ 9,000 + Remediation = $ 54,000	$63,000
	Restricted Use - Engineering Control - DER	Asphalt Cap + Engineering/Construction = $53,000 + Maintenance Cost 30 yr Present Worth = $ 17,000	$70,000
10,000 Gallon Diesel Fuel AST (West Yard)	None - Unrestricted Use	Excavation and Off-Site Disposal + Delineation = $ 2,000 + Remediation = $ 16,000	$18,000
Area A (West Yard)	None - Unrestricted Use	Excavation and Off-Site Disposal	$1,241,000
	Restricted Use - Engineering Control - DER	Soil Cap + Engineering/Construction = $305,000 + Maintenance Cost 30 yr Present Worth = $ 52,000	$357,000
Area A Soil Piles (West Yard)	None - Unrestricted Use	Off-Site Disposal	$159,000
	Restricted Use (Part of Fill for Area A Cap)	Soil Reuse	$64,000
MW-18 Free Product (West Yard)	Not Applicable	Surfactant Enhanced Recovery + Delineation = $ 7,000 + Remediation/Monitoring = $ 24,000	$31,000
Dissolved Ground Water	Classification Exception Area (CEA)	Natural Remediation + Natural Remediation Plan = $ 31,000 + 3-year Semi-Annual Monitoring = $ 66,000	$97,000